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CONTENTS OF VOLUME XXXIX, No. 1.

PAGE

SOME BEAUTIFUL INDIAN TREES. (Part XXI). By the late E. Blatter, S.J., Ph.D, F.L.S., and W. S. Millard, F.Z.S. (*With one coloured plate and two black and white plates*) 1

THE ORNITHOLOGY OF TRAVANCORE AND COCHIN. Part VI. By Salim Ali, with notes by H. Whistler. (*With one plate*) 3

THE FOXES OF BRITISH INDIA. By R. I. Pocock, F.R.S. (*With three text figures*) 36

THE SNAKES OF DEOLALI. Part I. By A. G. L. Fraser, I.M.D. (*With two plates and 2 text figures*) 58

THE BIRDS OF BOMBAY AND SALSETTE. Part I. By Salim Ali and Humayun Abdulali. (*With a map and four plates*) 83

SHOOTING NOTES FOR THE CENTRAL PROVINCES. By J. E. Hall. (*With a plate*) 104

NOTES ON SOME INDIAN BIRDS. By E. H. N. Lowther, M.B.O.U., F.Z.S. (*With 6 plates*) 116

THE NESTING OF THE INDIAN CRESTED SWIFT (*Hemiprocne coronata*) IN UPPER BURMA. By J. K. Stanford, I.C.S., and H. C. Smith, I.F.S. 125

THE MEDICINAL AND POISONOUS AROIDS OF INDIA. By. F. Caius, S.J., F.L.S. 127

OBSERVATIONS OF SOME PECULIAR HABITS OF THE SPIDER (*Marpissa melanognathus.*) By Dr. Gopal Chandra Bhattacharya (*With two plates*) 142

AN UNDESCRIBED TINGITID FROM SOUTH INDIA. By C. J. Drake 145

NOTES ON COCCIDÆ (*Homoptera rhynchota*) FROM SOUTH INDIA. By Rao Sahib Dr. T. V. Ramakrishn Ayyar, B.A., Ph.D 146

A PRELIMINARY SURVEY OF THE ALGAL FLORA OF HYDERABAD (*Deccan*). Part I. By M. Ghousuddin, M.Sc. (*With two plates*). 149

REVIEW :—

Indian Science Abstracts 151

OBITUARY :—

H. M. Phipson 152

MISCELLANEOUS NOTES :—

I.—Association between a Leopard and a Tigress. By Iftikhar Ali Khan 155

II.—Curious companionship between Panther and Wild Boar. By J. Monteath, I.C.S. 157

III.—Number of Cubs in a Tigress litter. By Lt.-Col. C. G. Toogood, D.S.O. 158

IV.—Ratels and Corpses. By F. W. Champion, I.F.S. 159

V.—Ratels and Corpses. By A. A. Dunbar Brander 161

VI.—Do Porcupines shoot their quills? By KIM 162

VII.—Are Hares unclean animals? By F. W. Champion, I.F.S. 163

VIII.—Peculiar behaviour of an Elephant. By R. C. Morris, F.Z.S. 164

IX.—Bison—Variation in colouration of the exposed part of the Snout and Tongue. By C. H. Biddulph 165

X.—White Bison. By R. C. Morris, F.Z.S. 165

XI.—White Bison in South Coimbatore. By J. Williams 166

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Digitized by Arya Samaj Foundation Chennai and eGangotri

PAGE

XII.—Some Hoghunting Reminiscences. By J. C. A..... 168

XIII.—Horn growth as observed in Black Buck and Nilgai. By Iftikhar Ali Khan. (*With a photo*)..... 170

Horn Growth in the Nilgai. By C. H. Biddulph... 171

Horn Growth in Nilgai. By E. A. D'Abreu..... 171

XIV.—Colour sense in wild animals. By H. A. Wood..... 173

XV.—Crow assemblies. By P. A. Dalal.. 173

XVI.—An Albino Nilgiri Pipit (*Anthus nilghiriensis* Sharpe). By C. B. Beadnell..... 174

XVII.—The Indian Cuckoo (*Cuculus m. micropterus* Gould). By H. V. O'Donel..... 175

XVIII.—A Cuckoo (*C. canorus* Linn.) incident. By H. Jones..... 175

XIX.—The Burmese Plaintive Cuckoo (*Cacomantis merulinus querulus* Heine). By T. R. Livesey..... 177

XX.—The Small Green-billed Malkoha (*Rhopodytes viridirostris*) Jerdon. By C. H. Biddulph..... 178

XXI.—Indian Roller or Blue Jay (*Coracias benghalensis* Linn.) feeding on a Scorpion. By U. S. Sharga, Ph.D., F.E.S... 179

XXII.—On the breeding of the Pied Harrier (*Circus melanoleucus* Pennant) in Northern Burma. By J. K. Stanford 179

XXIII.—Altitudinal Range of the Ashy Wood Pigeon (*Columba pulchricollis* Blyth). By G. S. Lightfoot.... 181

XXIV.—Migration of Flamingo (*Phoenicopterus ruber antiquorum* Temm.) from North Gujerat. By Hari Narayan Acharya, F.Z.S..... 182

XXV.—Do Birds employ ants to rid themselves of ectoparasites. By B. B. Osmaston, I.F.S. (Retd.)..... 182

XXVI.—Wanted information about Heronries in South India. By F. N. Betts..... 183

XXVII —A Mugger (*Crocodilus palustris*) with one foot missing. By C. H. Biddulph. (*With a photo*)..... 184

XXVIII.—An Encounter with a Hamadryad (*Naia bungarus*). By R. N. Champion Jones..... 185

XXIX.—A Hamadryad's (*Naia bungarus*) nest and eggs. H. C. Smith, I.F.S. (*With a plate*)..... 186

XXX.—The Green Pitt Viper (*Trimeresurus gramineus*). By Dr. Malcolm Smith..... 188

XXXI.—Description of a new species of fish from Northern Bengal. By G. E. Shaw and E. O. Shebbeare. (*With a plate*)... 188

XXXII.—On the diet of the fish *rita rita*. By E. A. D'Abreu..... 189

XXXIII.—A Dragonfly preying upon a Spider. By T. V. Subrahmanyam 190

XXXIV.—Miscellaneous observations on the Biology of Aleurodidae (*Aleurodes brassicae*). By V. G. Deshpande..... 190

XXXV.—Does the Giant Wood Spider (*Nephila maculata*) live more than one season By C. McCann..... 194

XXXVI.—Parental care and cannibalism in Arachnids. By C. McCann..... 194

XXXVII.—Mating of the Spider Tetragnatha. By T. V. Subrahmanyam. 197

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CONTENTS OF VOLUME XXXIX, No. 2.

PAGE

THE GAME FISHES OF INDIA. By Dr. S. L. Hora, D.Sc., F.R.S.E., F.L.S., F.Z.S., F.R.A.S.B., F.N.I. (*With one plate and three text figures*) 199

THE MONGOOSES OF BRITISH INDIA, including Ceylon and Burma. By R. I. Pocock, F.R.S. (*With two text-figures*) 211

THE VERNAY SCIENTIFIC SURVEY OF THE EASTERN GHATS. By H. Whistler, M.B.O.U., assisted by N. B. Kinnear, M.B.O.U. Part XV... 246

THE SNAKES OF DEOLALI. Part II. By A. G. L. Fraser, I.M.D. (*With three plates and one text figure*) 264

A NEW CARTON-BUILDING SPECIES OF ANT IN SOUTH INDIA. *Crematogaster dohrni artifex*, Mayr. By P. N. Krishna Ayyar. (*With four plates*) 291

THE MALAYAN OR BURMESE SAMBAR (*Rusa unicolor equinus*). By W. S. Thom. (*With a plate*) 309

THE ORNITHOLOGY OF TRAVANCORE AND COCHIN. Part VII. By Salim Ali 320

THE PRAWN INDUSTRY OF THE MALABAR COAST. By N. K. Panikkar, M.A., M Sc. (*With three plates.*) 343

NOTES ON MURREE BIRDS. By Rev. E. A. Storrs Fox 354

ON TWO NEW SPECIES OF ANTHOCEROS Linn. 1753 from Southern Shan States, Burma, with a comparative Chart of the dioecious dark spored species of the Genus. By L. P. KHANNA (*With two plates*). 358

THE MEDICINAL SPIDERWORTS OF INDIA. By Rev. J. F. Caius, S.J., F.L.S. 361

ABOUT SPIDER COLLECTION. By T. V. Subrahmaniam. (*With one plate and 8 text-figures*) 366

AN APOLOGY 373

REVIEWS :—

Natural History. By C. Tate Regan, D.Sc., F.R.S. 374

Les serpents de l'Indochine. By René Bourret 374

Questions agricoles 375

OBITUARIES :—

A. J. W. Milroy 376

Sir George Hampson, Bt 379

Dev Dev Mukerji (1903-1937) 379

MISCELLANEOUS NOTES :—

I.—Observations on the Grey Musk Shrew (*Suncus cæruleus*). By C. McCann 380

II.—Black Tigers. By S. H. Prater 381

III.—Ravages by tiger and incidence of Man-eaters in North Coimbatore between 1860 and 1880. By R. C. Morris... 382

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Digitized by Arya Samaj Foundation Chennai and eGangotri

PAGE

IV.—Tiger smoked to death in a cave. By S. A. Christopher.. ... 385

V.—Tiger lore in Burma. By S. A. Christopher..... 386

VI.—Young elephant killed by a tiger. By C. H. Biddulph..... 387

VII.—The result of excess poison for Wild Dogs. By R. C. Morris. 388

VIII.—The Striped Hyæna as a Man-eater. By S. H. Prater..... 388

IX.—A very large Sambar Stag. By R. C. Morris..... 390

X.—A Big Buffalo head. By S. A. Christopher..... 391

XI.—Gaur Bulls attacking a wounded Bull. By R. C. Morris..... 391

XII.—Whipsnade Zoo. By Lt.-Col. R. W. Burton, I.A (Retd.)... 391

XIII.—Do birds employ ants to rid themselves of Ectoparasites. By Major R. S. P. Bates..... 394

XIV.—Some rare birds in Northern Burma. By J. K. Stanford..... 395

XV.—Curious nesting sites of the Large Pied Wagtail (*Motacilla lugubris maderaspatensis* Gmel.) By C. H. Biddulph. 397

XVI.—The Habits of Vultures. By T. R. Livesey..... ... 398

XVII.—Eagles on the Nilgiris. By H. E. Burgess..... 399

XVIII.—The distribution and Nidification of the Greater Spotted Eagle (*Aquila clanga* Pallas) in Sind. By K. R. Eates 403

XIX.—Number of Eggs laid by the Indian Shikra (*Astur badius dussumieri* Temm. and Lang.) By C. H. Biddulph ... 406

XX.—The Status of the Koel (*Eudynamis scolopaceus* L.) in Sind. By K. R. Eates. (*With a Map*)..... ... 406

XXI.—The distribution and Nidification of the Large Indian Paroquet (*Psittacula eupatria nepalensis* Hodgs.) in Sind. By K. R. Eates..... 414

XXII.—The Ceylon Hoopoe (*Upupa epops ceylonensis* Reichb.). By R. N. Champion-Jones..... 418

XXIII.—Note on the Sandpipers in the Patna District, Behar, recording the occurrence of the Avocet Sandpiper, the Curlew Stint and the Broad-Billed Stint, from inland localities. By E. A. D'Abreu..... 419

XXIV.—Sarus Flocks. By T. R. Livesey..... 420

XXV.—A Mugger (*Crocodilus porosus*) with a broken lower jaw. By C. H. Biddulph..... 421

XXVI.—Notes on the Pond Terrapin (*Geoemyda t. trijuga*) in salsette Island. By C. McCann..... 423

XXVII.—Notes on the breeding of the Rat Snake or Dhaman (*Zamenis mucosus*). By C. McCann..... 423

XXVIII.—Snakes' method of swallowing prey. By F. N. Betts..... 424

XXIX.—The Giant Wood Spider. By R. N. Champion-Jones..... 425

XXX.—Notes on the Moulting process of the Spider (*Myrmarachne plataleoides*, Camb.) By G. C. Bhattacharya (*With four text-figures*)..... 426

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CONTENTS OF VOLUME XXXIX, No. 3.

PAGE

THE GAME FISHES OF INDIA. By Dr. S. L. Hora, D.Sc., F.R.S.E., F.L.S., F.Z.S., F.R.A.S.B., F.N.I. (*With one coloured plate and 8 text-figures*). The Bachhwa or Butchwa..... 431

THE VERNAY SCIENTIFIC SURVEY OF THE EASTERN GHATS. Part XVI. By H. Whistler, M.B.O.U., assisted by N. B. Kinnear, M.B.O.U..... 447

THE SNAKES OF DEOLALI. Part III. By A. G. L. Fraser, I.M.D. (*With four plates*)..... 464

FISH OF DEOLALI. Part I. By Dr. S. L. Hora, D.Sc., F.R.S.E., F.N.I., and K. S. Misra, M.Sc. (*With two plates*)..... 502

THE BIRDS OF BOMBAY AND SALSETTE. Part II. By Salim Ali and Humayun Abdulali. (*With three plates.*)..... 520

NOTES ON THE COMMON LAND CRAB *Paratelphusa* (*Barytelphusa*) *guerini* OF SALSETTE ISLAND. By C. McCann, F.L.S. (*With two plates*)..... 531

NOTES ON SOME INDIAN BIRDS. By E. H. N. Lowther, M.B.O.U., F.Z.S. (*With five plates*)..... 543

NOTES ON SOME BIRDS RECORDED FROM BURMA. By P. F. Garthwaite, B.F.S., assisted by Dr. C. B. Ticehurst, M.A., M.R.C.S., M.B.O.U..... 552

THE MEDICINAL AND POISONOUS CAMPIONS OF INDIA. By J. F. Caius, S.J..... 561

THE ORNITHOLOGY OF TRAVANCORE AND COCHIN. Part VIII. By Salim Ali, with notes by H. Whistler, M.B.O.U..... 569

BIRD LIFE ON A SOUTHERN INDIAN TANK. B. F. N. Betts. (*With two plates*)..... 594

REVIEWS :—

Manual of the Mammals of Ceylon. By W. W. A. Phillips..... 603

A Guide to collecting Butterflies of India. By Lt.-Col. H. D. Peile..... 603

A Beast Book for the Pocket. By Edmund Sanders..... 605

NOTE ON THE BURMA WILD LIFE PROTECTION ACT..... 606

AN APPEAL—Wanted Stag Beetles. By G. J. Arrow..... 609

MISCELLANEOUS NOTES :—

I.—Association between a Leopard and a Tigress. By Brigadier-General R. G. Burton..... 610

II.—Two wary Tigers and two others. By R.C. Morris, F.R.G.S., F.Z.S..... 610

III.—Strange behaviour of a tigress. By E. P. Gee..... 614

IV.—Measurements of tigers in the Naga Hills, Assam. By G. H. L. Marshall..... 615

V.—Mange on Wild Dogs. By R. C. Morris..... 615

VI.—Notes on Hardwicke's Hedgehog (*Hemiechinus collaris* Gray and Hardw.) By C. McCann..... 616

VII.—Solitary Bull Bison (*Bibos gaurus* H. Sm.). By R. C. Morris..... 617

VIII.—Whistling sound made by Bison (*Bibos gaurus* H. Sm.). By C. H. Biddulph..... 617

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CONTENTS OF Vol. XXXIX, No. 3

PAGE

IX.—Colouration of the Bison's snout and tongue. By R. C. Morris 618

X.—Replacement of horns in Nilgai. By M. K. S. Chandrabhanusinhji 618

XI.—An Elephant 170 years old. By Guy Dollman 619

XII.—Whale-bone Whale stranded on the Travancore Coast. By R. V. Poduval 620

XIII.—Unclean animals. By A. A. Dunbar Brander 620

XIV.—Close seasons for Big Game—Are they beneficial? By R. C. Morris 621

XV.—Occurrence of the Rufous short-toed Lark (*Calandrella brachydactyla dukhunensis* Sykes) in Northern Burma. By J. K. Stanford, I.C.S. 623

XVI.—The Egg-laying of the Khasia Hills Cuckoo (*Cuculus canorus bakeri* Hartert). By T. R. Livesey 623

XVII.—Cuckoo incidents. By T. R. Livesey 626

XVIII.—A Note on the distribution and nidification of the Northern yellow-fronted Pied Woodpecker [*Leiopicus mahrattensis blanfordi* (Blyth)] in Sind. By K. R. Eates, F.Z.S., M.B.O.U. 628

XIX.—The Distribution and Nidification of the Rock Horned Owl (*Bubo bubo bengalensis* Frankl.) in Sind. By K. R. Eates, F.Z.S., M.B.O.U. 631

XX.—Occurrence of the Chinese Lesser Kestrel (*Cerchneis naumanni pekinensis* Swinh.) in Northern Burma. By J. K. Stanford, I.C.S. 633

XXI.—Notes on Birds of Prey in the Madras Presidency. By C. H. Biddulph 634

XXII.—Unusual site for the nest of the White Scavenger Vulture [*Neophron percnopterus ginginianus* (Lath.)] By C. H. Biddulph 635

XXIII.—Behaviour of Jerdon's Little Ringed Plover (*Charadrius dubius jerdoni* Legge) with young. By K. R. Eates, F.Z.S., M.B.O.U. 636

XXIV.—Intergradation of the races of the Spot-Billed Duck (*Anas pœcilorhyncha* Forster). By R. E. Parsons 638

XXV.—Occurrence of Mallard (*Anas platyrhyncha* Linn.) at Hoshangabad. By J. Miles Stapylton 639

XXVI.—The Nukhta or Comb Duck (*Sarkidiornis melanotos* Pennant) in Assam. By W. M. LeMarchand 639

XXVII.—Occurrence of the Great-crested Grebe (*Podiceps cristatus cristatus* L.) at Maymyo, Upper Burma. By P. F. Garthwaite, B.F.S. 640

XXVIII.—Birds and Ants. By T. Bainbrigge Fletcher 640

XXIX.—A Bloodsucker (*Calotes versicolor*) attacking an adult bird. By C. H. Biddulph 640

XXX.—The Butterfly (*Rhinopalpa polynice burmana*) in the N.-E. Frontier, Assam. By R. E. Parsons 641

XXXI.—Curious behaviour of a wasp. By C. H. Biddulph 641

PROCEEDINGS OF THE ANNUAL MEETING OF THE BOMBAY NATURAL HISTORY SOCIETY 644

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CONTENTS OF VOLUME XXXIX, No. 4.

PAGE

THE GAME FISHES OF INDIA. Part III. By Dr. S. L. Hora, D. SC., F.R.S.E., F.L.S., F.Z.S., F.R.A.S.B., F.N.I. (*With one coloured plate and 9 text-figures*). Garua Bachcha or Gaurchcha..... 659

THE BIRDS OF BOMBAY AND SALSETTE. Part III. By Salim Ali and Humayun Abdulali. (*With one plate*) 679

FISH OF DEOLALI. Part II. By A. G. L. Fraser, I.M.S. (*With one plate*)..... 689

THE MEDICINAL AND POISONOUS CROWFOOTS OF INDIA. By J. F. Caius, S.J., F.L.S. 712

THE NAMES OF TWO INDIAN VIPERS. By Malcolm Smith, M.R.C.S..... 730

GAME BIRDS IN THE ANAIMALAI HILLS AND THE SOUTH COIMBATORE DISTRICT. By J. Williams. (*With one plate*)..... 732

A PRELIMINARY ACCOUNT OF THE APHIDIDAE OF POONA. By V. G. Deshpande, M. AG. (Bom.), PH. D. (Edin.)..... 740

SOME ADDITIONS TO THE FAUNA OF IRAQ. By Walter P. Kennedy..... 745

MARRIAGE FLIGHT AND COLONY FOUNDING OF THE COMMON BLACK ANT *Camponotus* (*Tanaemyrmex*) *compressus* LATR. By P. N. Krishna Ayyar. (*With 3 text-figures*)..... 750

DESCRIPTION OF A NEW SPECIES OF AGAMID LIZARD FROM UPPER BURMA. By Malcolm Smith, M.R.C.S..... 755

BUTTERFLIES AND MOTHS FROM CHINESE TURKESTAN. By Lt. Col. J. W. Thomson-Glover.. 756

MOSSES COLLECTED IN ASSAM. By H. N. Dixon, M.A., F.L.S. (*With one plate*)..... 769

SOME DATA ON THE FAUNA: BLATTODEA, MANTODEA, PHASMODEA AND ORTHOPTERA OF NORTH AFGHANISTAN. By Leo Mistshenko. (*With 6 text-figures*) 796

THE KODAIKANAL BIRDS AND HOW TO NAME THEM. By Edward G. Nichols..... 812

SOME BIRDS OF LYALLPUR AND THEIR FOOD. By M. Afzal Husain, M.A. (Cantab.), I.A.S. and Hem Raj Bhalla, B. SC. (Agri.)..... 831

NOTES ON *Calotes versicolor* (DAUDIN) JERDON. By Charles McCann, F.L.S. (*With 3 plates*)..... 843

REVIEW :—

SOME BEAUTIFUL INDIAN TREES. By the late Rev. E. Blatter, S.J., PH.D., F.L.S. and Walter S. Millard..... 849

MISCELLANEOUS NOTES :—

I.—Smoking a Panther to Death. By the Chief of Ichalkaranji. 850

II.—The Size of the Jungle Cat (*Felis chaus affinis*). By E. P. Gee..... 850

III.—The Alleged Wild Dog of Mt. Popa, Burma. By R. I. Pocock..... 851

IV.—Curious Behaviour of Bison (*Bibos gaurus* H. Sm.) By C. G. Toogood..... 852

V.—Abnormal Elephant Tusks (*Elephas maximus*). By G. D. L. Millar. (*With a plate*)..... 854

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PAGE

VI.—Abnormal Horn Growth in the Muntjac(*Muntiacus vaginalis*). By F. H. Peppe. (*With a photo*) 854

VII.—The Use of Firework or Rocket Cartridges in the Protection of Crops. By R. C. Morris..... 855

VIII.—Some Notes on the Fauna of Malaya. By H. E. Burgess.... 856

IX.—Some Interesting Records of Birds in the Punjab. By H .W. Waite, M.B.O.U..... 861

X.—Migratory Movements of three well-known Birds in the Tanjore and South Arcot Districts. By C. H. Biddulph. 862

XI.—Curious Behaviour of the Jungle Crow (*Corvus macrorhynchus*) and the White-backed Vulture (*Gyps bengalensis*). By C. McCann 864

XII.—The Distribution of the White-eared Bulbul [*Molpastes leucogenys leucotis* (Gould)] in the Swamps near the Vaitarna River. By C. McCann..... 864

XIII.—The Southern Indian Roller or Blue Jay [*Coracias benghalensis indica* (Linn.)] killing a Small Snake. By C. H. Biddulph..... 865

XIV.—Breeding of the Little Indian Nightjar(*Caprimulgus asiaticus asiaticus*) in the Chingleput District. (*With a plate.*) By Alice D. Barnes..... 865

XV.—On the Breeding of the Oystercatcher (*Haematopus ostralegus* Subsp.) and other Birds in the Bengal Sunderbunds. By J. K. Stanford 867

XVI.—Early and Late Snipe. By Brigadier G. de La P. Beresford, M. C..... 868

XVII.—The Breeding of the Little Green Bittern (*Butorides striatus javanicus*) in Salsette Island. By C. McCann 869

XVIII.—Occurrence of the Bittern (*Botaurus s. stellaris*) in South Mysore. By Major E. G. Phythian-Adams, I.A..... 870

XIX.—Sexual Dimorphism in the Star-shelled Tortoise (*Testudo elegans*). By C. McCann..... 870

XX.—Occurrence of *Psammophis condanarus*? in Berar. By E. O. Shebbeare..... 871

XXI.—Sexual Dimorphism in the Seasnake [(*Distira cyanocincta* (Daud.)] By C. McCann..... 872

XXII.—Breeding Season of the Jew's Nosed Seasnake [*Enhydrina valakadyen* (Boie)] in Bombay Waters. By C. McCann. 872

XXIII.—Freak Seedling of the Grape Fruit. By Mrs. Margaret Rath. (*With a photo*)..... 873

XXIV.—Some Observations on Botanical Nomenclature. By C.E.C. Fischer..... 874

XXV.—The Flowering of *Strobilanthes*. By J. H. L. Williams..... 877

PROCEEDINGS OF A MEETING OF MEMBERS OF THE BOMBAY NATURAL HISTORY SOCIETY HELD ON THE 25TH AUGUST, 1937..... 880

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John Bale Sons & Danielsson, Ltd. London.

The Padauk.

Pterocarpus indicus, Willd.

(about ⅓rd nat. size.)

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गुरुकुल कांगड़ी विश्वविद्यालय
हरिद्वार

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SOME BEAUTIFUL INDIAN TREES.

BY
THE LATE E. BLATTER, S.J., PH.D., F.L.S.,
and W. S. MILLARD, F.Z.S.

PART XXI.

(*With one coloured plate and two black-and-white plates*).

(*Continued from page* 417 *of volume* xxxviii).

THE PADAUK.

Popular Names: *Padauk* (Burma); *Padauk* (Malay).

Though commonly referred to as the Padauk in towns and stations, this is not the true Padauk of Burma which is *Pterocarpus macrocarpus* Kurz.

Pterocarpus indicus Willd. ed. sp. iii, 904. Belongs to the family *Leguminosae*. The generic name derived from the Greek means winged fruit, and refers to the condition of the pods produced by trees of the genus.

Description: The tree grows to a height of 50 ft. It has a straight trunk with smooth olive-coloured bark and a wide crown of dark green foliage and wavy drooping branches. The branches are few and tend to form low on the comparatively short bole. The leaves 8-10 in. long grow alternately on the branches. Each leaf is composed of 8-10 leaflets arranged alternately on the stalk. The leaflets are from 3-4 in. long and 2-2½ in. broad. They are glossed on both sides, oval, with smooth margins and notched at the apex, their stalks smooth, slightly channelled and flexuous. Early in the rains the tree is covered with clusters of fragrant deep orange or yellow flowers. They grow in single or compound racemes from the joints of the branchlets while single racemes form a much larger panicle at the ends of the branchlets. The flower has a short five-toothed calyx, the two upper lobes being larger than the rest. The petals comprise an erect, wrinkled, claw-like banner petal flanked by two curly wing petals of the same colour, and two smaller, paler and less curly keel petals. The ten stamens are united to form two equal bunches of five, capped

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by small, two-lobed deep yellow anthers, the style is shorter than the stamens and the stigma acute. The pod is 1-2 in. in diameter. It is round and wrinkled, very tough and woody, its central part containing one, rarely two brown smooth and shining seeds.

Flowering and fruiting: The flowers appear in two or three separate flushes early in the rainy season, about May to July and the pods ripen in the cold season, about January and February (Troup).

Mr. R. H. Macaulay of Wallace Bros. & Co. (Bombay-Burma Trading Corporation), writes as follows: 'The peculiarity of the tree is that all the Padauk trees burst into flower on the same day. If I saw a Padauk in flower in the bungalow compound, I was sure to see Padauks in flower all the way down to my office in Rangoon. I think the flower did not last long and fairly soon the trees flowered again. The Burmans used to say that the rains would not come until the Padauk had flowered three times.'

The flowers are so short-lived that it has been with much difficulty that we have been able to obtain a coloured sketch of this tree.

Distribution and habitat: This tree is believed to be indigenous in the Malay Peninsula and Archipelago, whence it has been introduced into Burma, where it is largely planted in gardens and along roadsides and avenues in the damper parts of the country. It has also been planted to a small extent about Calcutta and Madras. More recently it has been introduced into Bombay, where it promises to do well (Troup).

This tree was first introduced into Bombay by Mr. Justice (afterwards Sir Edmund) Fulton, I.C.S., who sent three or four young trees from Rangoon to Mr. W. S. Millard about 1906. These were all planted and have flourished, the one planted in the University Gardens flowering each year in the month of May. There are a considerable number of these trees growing in and around Bombay now.

Uses: In Burma it is not important as a timber tree, but is largely planted for shade and ornament, the tree being in full foliage during the hot weather when shade is most required.

Gardening: The tree may be propagated from seed; loose soil and protection from sun favour the early development of the seedling, but the seedlings are very sensitive to frost and do not survive when frosts are prevalent. The tree thrives best in a tropical climate with a rainfall of not less than 60 in. It requires a deep well-drained soil and does not thrive on stiff clay. The tree is commonly propagated by large cuttings which should be planted in prepared pits in rather sandy soil early in the rainy season, or, if watering can be carried out, about the month of February. Nursery-raised plants are ready for transplanting at the commencement of the second rains, when they are rather more than one year old: planting can be most successfully carried out by transferring the seedlings to bamboo baskets during the first rains and planting them out in the baskets during the second rains (Troup).

(*The end*).

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Flowering spray of the Padouk (*Pterocarpus indicus*).

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The Padouk Tree, *Pterocarpus indicus* (Ballard Estate, Bombay).

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THE ORNITHOLOGY OF TRAVANCORE AND COCHIN.

BY

SÁLIM ALI.

With Notes by HUGH WHISTLER.

PART VI.

(With one Plate).

(Continued from page 790 of volume xxxviii).

SUB-ORDER: CUCULI.

FAMILY: CUCULIDÆ.

Cuculus canorus subsp.? The Cuckoo.

Not met with by the Surveys. I have seen a specimen in the Trivandrum Museum marked '♂ 27-7-77' presumably from Travancore, but without locality. Ferguson (*J.B.N.H.S.*, xv, 664) refers to another shot in Trivandrum in February 1893 which is apparently not in the museum now. He describes the bird as a rare winter visitor to Travancore. The race is indeterminate.

THE VERNAY SCIENTIFIC SURVEY OF THE EASTERN GHATS.

(ORNITHOLOGICAL SECTION).

BY

HUGH WHISTLER, M.B.O.U., assisted by N. B. KINNEAR, M.B.O.U.

PART XV.

The MS. of this Part was received too late for inclusion in this number. It will appear in the next issue.—EDS.

It has not been recorded from the Palni Hills and is a rare winter visitor to Ceylon.

Breeding: The specimen (17 March) was breeding. There was considerable development in its ovary, and the largest follicle measured over 11 mm. in diameter. The distended oviduct indicated that laying had commenced.

Nidification (iii, 347) records that Stewart obtained a complete oviduct egg from a female shot by him in Travancore. It was all blue of rather a grey shade. Unfortunately the date is omitted.

Hierococcyx varius Vahl. The Common Hawk-Cuckoo.

Specimens collected: 468 ♀ 19-3-33, 483 ♀ 21-3-33 Rājampāra 1,350 ft.; 593 ♂ juv. 14-4-33 Cape Comorin ca. S.L.; 790 ♂ 5-8-33 (Nettayam 200 ft.) Trivandrum Environs.

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BY

SÁLIM ALI.

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[I have no information beyond the above record of Ferguson's. There appear to be only three or four records from Ceylon and so far as I am aware, the race represented by those specimens has not been properly verified. —H. W.]

Cuculus micropterus micropterus Gould. The Indian Cuckoo.

Specimen collected: 458 ♀ 17-3-33 Rājampāra 1,350 ft.

Elsewhere not noted. Heard at Trivandrum, but either this or *Penthoceryx*?

Colours of bare parts: Iris brown; gape and rim round eye (eyelids) bright lemon yellow; bill, upper mandible horny-brown, lower mandible greenish-brown, yellow at chin; mouth yellowish-pink; legs and feet yellow; claws horny-brown.

[The specimen measures: Bill 28.5; wing 190.5; tail 148 mm. No other Travancore specimens seen. The few South Indian and Cinghalese specimens that I have seen appear to be identical with Himalayan birds, but more breeding material is required before the point can be definitely settled.—H. W.]

Ferguson's remarks (*J.B.N.H.S.*, xv, 664) imply that the Indian Cuckoo is a resident species in Travancore. He mentions that the only two specimens in the Trivandrum Museum in his time were shot in the low country, and that he never came across it in the hills. According to him it frequents forest, and its loud cry may be heard in April and May especially towards dusk. The Survey specimen was obtained in deciduous forest in the Panthalam Hills at about 1,500 ft. elevation. It was solitary. The well-known call, which in the light of the modern craze may be aptly syllabified as *Cross-word Puzzle* repeated *ad nauseam*, was not at all commonly heard by the end of April when the Survey concluded its field work. The species, in fact, appeared to be definitely rare, and Kinloch also does not include it in his Nelliampathies lists.

It has not been recorded from the Palni Hills and is a rare winter visitor to Ceylon.

Breeding: The specimen (17 March) was breeding. There was considerable development in its ovary, and the largest follicle measured over 11 mm. in diameter. The distended oviduct indicated that laying had commenced.

Nidification (iii, 347) records that Stewart obtained a complete oviduct egg from a female shot by him in Travancore. It was all blue of rather a grey shade. Unfortunately the date is omitted.

Hierococcyx varius Vahl. The Common Hawk-Cuckoo.

Specimens collected: 468 ♀ 19-3-33, 483 ♀ 21-3-33 Rājampāra 1,350 ft.; 593 ♂ juv. 14-4-33 Cape Comorin ca. S.L.; 790 ♂ 5-8-33 (Nettayam 200 ft.) Trivandrum Environs.

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Elsewhere noted at: Marāiyūr (3,500 ft.); Sānthanpāra (3,500 ft.); Thattakād (200 ft.); Tenmalai (500 ft.); Trivandrum Town; Balamore Estate (2,000 ft.—Ashāmbū Hills); Wadakkāncheri (400 ft.); Karūpadanna (ca S.L.).

Colours of bare parts: *Adult*: Iris greyish-yellow or yellowish-buff; rim round eyes (eyelids) and gape lemon yellow; bill yellowish-green, black on culmen and tips; mouth pink and yellow; legs, feet and claws bright chrome yellow. *Juvenile*: Iris greyish-brown; bill pale brownish-yellow; gape and mouth yellow; legs, feet and claws pale yellow.

[Measurements:

	Bill.	Wing.	Tail.	Tarsus.
1 ♂ adult	27.5	moult	164.5	21 mm.
1 ♀ adult	26	194.5	—	23 mm.
1 ♀ imm.	25.5	183	147.5	— mm.

Other specimens examined: *Brit. Mus.*: ♀ no date Mynall (Hume Coll.); o? ad. no date Aneichardi Estate (Stewart).

The moult of this cuckoo seems very irregular, some feathers being moulted and others not, so that old and new feathers mingle in the plumage both in the first year and in the adult. Curiously enough this reminds one of the case of its favourite host *Turdoides somervillei*.—H. W.]

In the Travancore-Cochin area the Hawk-cuckoo is a common, generally distributed and obstreperous species in the low country, and through the foothills up to an elevation of about 1,000 ft. In smaller numbers it was met with up to at least 3,500 ft. Curiously enough Kinloch says (*J.B.N.H.S.*, xxvii, 940) that it does not occur in the Nelliampathy Hills at any season.

It frequents well-wooded country, gardens and groves of trees, near cultivation and human habitations as well as away from them. I never met the bird actually within evergreen forest. Its *Brain-fever* calls were heard all day long and often far into, or even throughout moonlit nights. They are usually uttered five or six times in succession, rising in a crescendo and ending abruptly, and are repeated with monotonous persistency.

According to Fairbank (*S.F.*, v, 397) the Hawk-cuckoo is common in the Palni Hills both at the base and higher up. Its status in Ceylon is uncertain. Legge considered it a winter visitor, but as the birds call incessantly throughout that period, and as Wait considers that some breed on the island, it may well be that the typical race as a migrant and a local race as a resident both occur. The only two specimens Mr. Whistler has examined from Ceylon seem darker than continental birds. The point requires investigation by workers in Ceylon.

Breeding: In specimen No. 483 (21 March) the ovary was distinctly granular and the follicles appeared to be enlarging. Some of them measured about 1 mm. in diameter. No. 593 (14 April) was a juvenile, just growing wing and tail quills. The forest-guard, who found it and brought it in alive, said it was being fed by 'other birds' (probably babblers), but on cross-examination supplied a highly colourable description of a woodpecker! The young uttered *Kē-kē* from time to time, very like that of *Turdoides somervillei* but somewhat high-pitched.

Cacomantis merulinus passerinus (Vahl.). The Indian Plaintive Cuckoo.

Specimens collected: 618 ♀ ad. (hepatic) 18-4-33 Arāmboli 250 ft.; 894 ♀ imm. 24-11-33 Wadakkāncheri 400 ft.

Elsewhere not noted.

Colours of bare parts: Iris in 618 (hepatic) chestnut brown, in 894 (imm.) pale brown; bill horny-brown, paler at chin and basal part of lower mandible; mouth bright orange-brick; gape in immature (894) orange; legs and feet brownish-yellow; claws horny-brown.

[Measurements:

	Bill.	Wing.	Tail.
1 ♀ ad.	23	113.5	104.5 mm.
1 ♀ juv.	22.5	113	114.5 mm.

No other Travancore specimens seen.—H. W.]

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The Indian Plaintive Cuckoo is apparently an uncommon (resident?) species in Travancore and Cochin. It was met with singly in the low country, in fairly dry scrub-and-bush jungle and light deciduous forest about cultivation, and was silent. The Trivandrum Museum in Ferguson's day contained only two specimens both shot in April in forest in the low country (*J.B.N.H.S.*, xv, 664).

It is a winter visitor to Ceylon.

Breeding: Nothing appears to be recorded from our area. Beyond the fact that No. 894 (24 November) was immature with an imperfectly ossified skull, no other evidence was obtained by the Surveys.

Penthoceryx sonnerati [sonnerati Latham]. The Banded Bay Cuckoo.

Not procured by the Surveys, but calls similar to those of *Cuculus micropterus*—in a higher key—heard in Trivandrum town and at Rājampāra presumably emanated from this species. We also have a sight record from Arāmboli, 18-4-1933. Ferguson (*J.B.N.H.S.*, xv, 664) merely states that it is decidedly rare in Travancore, and this we can confirm. Though probably a resident species, nothing is recorded about its breeding in our area.

Surniculus lugubris lugubris (Horsfield). The Indian Drongo Cuckoo.

Specimens collected: 311 ♀ 19-2-33 Kōttayam ca. S.L.; 961 ♀ 9-12-33 Nemmāra 300 ft.

Elsewhere noted at: Rājampāra (1,350 ft.—Panthalam Hills).

Colours of bare parts: Iris brown; bill brownish-black; gape (in 961) pale dusky orange; mouth pink (in 311), pale pink and creamy-orange (in 961); legs and feet pinkish plumbeous (in 311), greyish-brown (in 961); claws horny-brown.

[Measurements:

	Bill.	Wing.	Central Tail.	Outer Tail.
2 ♀♀	23.5-24	135-137.5	127-130	146.5-152 mm.

No other Travancore specimens seen.—H. W.]

The Surveys found the Drongo Cuckoo not common anywhere in Travancore and Cochin, but generally distributed in the low and foothills country. Ferguson (*J.B.N.H.S.*, xv, 665) believed it to be a resident species. The highest elevation at which it was met with was about 1,400 ft. It affects light forest in the neighbourhood of cultivation, the cashew, jack and cocoanut gardens surrounding the backwater homesteads, and pepper plantations, usually singly. Inspite of the superficial resemblance to the drongo, its flight and habits are characteristically cuculine.[1] It was silent on the whole, the only occasion when it was heard calling being on 19 March. The call consists usually of 6, but sometimes 7 or 8, musical whistling notes as if the bird was actually counting 1-2-3-4-5-6 etc. The whistles rise in scale and end abruptly, but the bird begins again after an interval of a few seconds. When perched silently the body is held erect and the resemblance to the drongo is then accentuated. When calling, however, the bird assumes a horizontal axis.

Its occurrence in the Palni Hills is unknown. It is a resident in Ceylon.

Breeding: The ovary of the specimen was in a quiescent state. *Nidification* (iii, 355) gives the breeding season in Travancore as January to March. J. Stewart is said to have taken an egg from a nest of the Black-headed Babbler (*Rhopocichla a. bourdilloni*).

Clamator jacobinus jacobinus (Boddaert). The Pied Crested Cuckoo (olim *taprobanus*. See Eastern Ghats Survey, *J.B.N.H.S.*, xxxvii, 523).

Specimens collected: 528 ♀ 7-4-33 Cape Comorin ca. S.L.; I have seen

---

[1] [A good deal is usually made of the resemblance of this cuckoo to a drongo and many writers tend to assume that it must therefore lay in drongos' nests. They do not, however, make the logical extension of the idea to *Hierococcyx* and *Cuculus* and suggest that they lay in hawks' nests! It should be remembered also that in Africa the drongo *Dicrurus ludwigi* has a close resemblance to the Black Flycatcher (*M. pammeliana*).—H. W.]

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two specimens in the Trivandrum Museum labelled: o? 21 and 22 Sept. 1898—Küttyäni.

Elsewhere noted at Arämboli (250 ft.).

Colours of bare parts: Iris brown; bill horny black; mouth pink; legs and feet brownish-slate; claws horny black.

[Measurements:

	Bill.	Wing.	Tail.	Tarsus.
1 ♀	25.5	143	150	26 mm.

No other Travancore specimens seen.—H. W.]

The Travancore Survey only came across this cuckoo in the low country about Cape Comorin and Arämboli in the extreme south of the State, where it was fairly common. It inhabits lightly wooded and Babül scrub terrain, and groves of trees in the neighbourhood of cultivation. According to Ferguson (*J.B.N.H.S.*, xv, 665) it is resident in Travancore.

Neither Fairbank nor Terry's lists from the Palni Hills include this cuckoo and its occurrence and status there needs to be determined. This form (typical) is resident in Ceylon.

Breeding: In the first half of April breeding was certainly in progress. Birds were constantly observed chasing one another and calling *Pee-pee* etc. One such party consisted of 8 birds which were very noisy. They were in a patch of open Babul scrub jungle where babblers (*Turdoides striatus*) were nesting.

The ovary of the specimen (7 April) was fully mature and contained soft eggs. On the same date a juvenile, lately out of nest, was observed being tended by a pair of White-headed Babblers. On the approach of the foster parents, the cuckoo shivered with partially outstretched wings and excitedly clamoured for food.

Clamator coromandus (Linnaeus). The Red-winged Crested Cuckoo.

Specimen not obtained. The Travancore Survey came across this cuckoo on three or four occasions among the scrub and bushes bordering the steep banks of the Periyär River at Thattakäd (ca. 200 ft.). It was always single, and silent. There is a specimen in the Maharaja's College Museum at Ernäkulam (Cochin State) collected in that neighbourhood.

According to Ferguson (*J.B.N.H.S.*, xv, 665) this cuckoo is a rare winter visitor to the hills and he refers to two specimens then in the Trivandrum Museum, shot at 2,500 and 4,000 ft. respectively in South Travancore.

It is said to be common in Ceylon.

Eudynamis scolopaceus scolopaceus (Linn.). The Indian Koel.

Specimen not obtained.

Noted at: Maräiyür (3,500 ft.); Thattakäd (200 ft.); Köttayam (ca. S.L.); Mündakäyam and Ürümbikera Reserve Forest (ca. 1,000 ft.); Arämboli (250 ft.); Wadakkäncheri (400 ft.); Shöranür; Nemmära (300 ft.); Karüpadanna (ca. S.L.).

Excepting at Maräiyür, the Koel was chiefly met with by the Surveys below an elevation of about 1,000 ft., and more especially in the low country. It is not common in the Travancore-Cochin area. According to Ferguson (*J.B.N.H.S.*, xv, 665) it is a resident species in Travancore and may occasionally be found in the hills. Kinloch (*J.B.N.H.S.*, xxvii, 939), however, includes it amongst the birds that are not found in the Nelliampathies at any season. I think its altitudinal as well as local status is largely co-ordinated with that of the crows, especially *Corvus splendens*, upon the nests of which it is habitually parasitic.

Fairbank (*S.F.*, v, 397) observed the Koel a few times in the Palni Hills, at what elevation is not stated. The typical race also occurs in Ceylon.

Breeding: There are no published records of its breeding in Travancore or Cochin. The Surveys obtained no precise data on this point apart from the fact that at Karüpadanna, House Crows were breeding in the second half of December, and as the Koels then were very excited and obstreperous they were presumably busy cuckolding them.

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Rhopodytes viridirostris (Jerdon). The Small Green-billed Malkoha.

Specimens collected: 88 ♀ 14-1-33 Marāiyūr 3,500 ft.; 595 ♂ 15-4-33 Arāmboli 250 ft.

Elsewhere not noted.

Colours of bare parts: Iris (fine outer ring white, inner claret; bill greyish-green; mouth brownish-black; wattly circumorbital skin pale blue; legs and feet greyish-slate or 'pale bluish-green, shading into greenish-blue' (Humayun and Pillai).

[See my note in the Eastern Ghats Survey Report (*J.B.N.H.S.*, xxxvii, p. 525) on the differences of white tips of tail feathers in Ceylon and South Konkan. Travancore birds lie between these extremes, but are closer to Ceylon.

I have seen five other Travancore specimens in the British Museum but with no very precise data.

In the juvenile bird the first primary is softer, broader and more rounded, as compared with the sickle-shaped first primary of the adult. The tail-feathers are narrower and the central pair have a very narrow brownish and white tip. The post-juvenal moult is complete. The post-nuptial moult is complete, and apparently there is no spring moult.—H. W.]

The Small Malkoha was met with by the Surveys only in the above two localities, where it seemed to be fairly common. It inhabited lightly wooded and scrub country of the deciduous type, and was seen either singly or in pairs. It undoubtedly prefers the broken foothills country, but Ferguson (*J.B.N.H.S.*, xv, 665) once obtained it at Peermade at about 3,000 ft. elevation. Fairbank (*S.F.*, v, 397) saw four at different times in the thickets at the eastern (dry) base of the Palni Hills. In Ceylon it occurs in the low country up to about 1,000 ft. elevation.

Breeding: The gonads of the specimens were undeveloped. On 19 April one of these Malkohas was observed building a fairly untidy saucer-shaped nest of thorny green twigs—some with leaves still attached. The site was about 4 ft. up in a cactus (*Euphorbia*) hedge, in broken scrub country at the foot of the hills in the Arāmboli Gap. The twigs were being plucked from a living tree some 20 yds. away, and only one of the birds was engaged in the work. On visiting the nest again on 28 April, Humayun found it to contain 2 eggs which he took. The eggs, white in colour, measured 27 × 22 and 27 × 21 respectively.

[**Phœnicophaus pyrrhocephalus** (Pennant). The Red-faced Malkoha.

Not met with by the Surveys. The *Fauna* (iv, 182) as well as *Nidification* (iii, 364) confidently mention that this Malkoha, hitherto considered strictly endemic to Ceylon, occurs in the extreme south of Travancore, where Stewart is said to have obtained it. Stewart's record or records, if authenticated by skins seem remarkable. Concerning the habits of this bird in its native island, Wait writes that it is very shy and haunts the wilder stretches of forest away from cultivation. The 'extreme south of Travancore' is particularly dry country compared with the rest of the State, and well outside the influences that conduce to the growth of dense forest elsewhere. On the face of it, therefore, the locality is physiographically an unlikely place to find this forest-loving Malkoha in, unless it has completely changed its habits upon setting foot on the mainland! It would be interesting to learn what exact locality Stewart obtained his specimens in and also some ecological details of the place.

With regard to the taking of its eggs in Travancore in April and May by Stewart (*Nidification*), these records should, I think, be accepted with a double dose of caution in view of what is said above, and also of the ever-present possibility of their vicariousness unless supported by the skins of the birds that laid them.]

Taccocua leschenaultii leschenaultii Lesson. The Southern Sirkeer Cuckoo.

Specimen collected: 408 ♀ 6-3-33 Kūmili 3,000 ft.

Elsewhere noted at: Marāiyūr (3,500 ft.); Arāmboli (250 ft.).

Colours of bare parts; Iris brown; bill cherry red, yellow at tips and

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brown along commissure; mouth slaty-black; legs and feet slaty; claws horny brown.

[The specimen measures:

Bill.	Wing.	Tail.
31.5	151	226 mm.

No other Travancore specimens seen except one 'Anjango' bird.—H. W.]

The Sirkeer Cuckoo is, on the whole, uncommon in Travancore. The Surveys failed to come across it in Cochin whence Kinloch likewise does not include it in his Nelliampathies list. It was observed singly or in pairs amongst undergrowth of tall grass and scrub in deciduous forest. At Arāmboli, where it was perhaps less rare than elsewhere, it frequented thin forest and scrub on the sides of the broken stony hills. At Marāiyūr an example was picked up dead and mutilated in an abandoned forest clearing with much undergrowth —possibly the work of a mongoose.

There is no published record of its occurrence in the Palni Hills, but it doubtless does so in suitable dry facies on the eastern slopes. It is a local resident in Ceylon.

Breeding: The specimen (6 March) had some of its ovarian follicles over 1.5 mm. in diameter. It was one of a pair and about to breed as was evident from the courtship in which it was engaged when shot. The display consisted of bowing (or bobbing) and posturing in ludicrous fashion, tail spread out and partly cocked, before the other of the pair. It is interesting to note that the advances in this case were being made by the female, the cock (? presumably—) though not altogether unresponsive, behaving in a much more passive and dignified manner!

On 17 April (Arāmboli) a bird was flushed off a nest in a cactus (*Euphorbia*) bush, about 10 ft. up, growing on a sparsely scrub-covered stony hillside. The nest was a shallow saucer-like structure of thorny twigs, lined with large dry leaves, and untidily wedged into a fork of the cactus. It was very similar to the Malkoha's nest. Termites had galleried up the stem of this cactus and some of their mud was actually within the nest itself. It contained two white eggs of a chalky texture—one addled, the other hard set—measuring 35 × 26 and 34 × 26 mm. respectively.

Nidification (iii, 366) records that Bourdillon obtained eggs of this cuckoo in Travancore in March and May. Two are said to form the normal clutch, but occasionally three or only a single are laid.

Centropus sinensis parroti Stresemann. The Southern Crow-Pheasant.

Specimens collected: 349 ♀ 24-2-33 Peermade 3,200 ft.; 537 ♂ 8-4-33 Cape Comorin ca. S.L.; 708 ♂ 22-7-33 (Pattom ca. 50 ft.); 782 ♂ 4-8-33 (Cattle Farm) Trivandrum Environs; 1031 ♀ 28-12-33 Karūpadanna ca. S.L.

Elsewhere noted at: Marāiyūr (up to 4,500 ft.); Mūnnār (5,000 ft.—Kannan Devan Hills); Sānthanpāra (3,500 ft.—Cardamom Hills); Rājampāra (1,350 ft. —Pandalam Hills); Tenmalai (500 ft.); Trivandrum Town; Arāmboli (250 ft.); Balamore Estate (2,000 ft.—Ashāmbū Hills); Kūriārkūtti (1,600 ft.—Annemalai Hills); Wadakkāncheri (400 ft.); Nemmāra (300 ft.); Pādagiri (3,000 ft.— Nelliampathy Hills); Trichur Town; Ernākulam.

Colours of bare parts: Iris 'blackish-grey' (Pillai), bright scarlet, pale claret or blood-red depending presumably on age; bill, legs, feet and claws horny-black; mouth palate slate, gullet pink or greyish-pink.

[The specimens measure:

	Bill.	Wing.	Tail.
3 ♂♂	39-41.5	173-183	197-238 mm.
3 ♀♀	39-43	186-198	243-271 mm.

Additional specimen seen: *Brit. Mus. Coll.*: ♀ 28-2-75 Colachul (Hume Coll.—H. W.]

Ferguson (*J.B.N.H.S.*, xv, 665) writes that in Travancore the Southern Crow-Pheasant is 'very abundant in the low country and about the foot of the hills'. This is its status in Cochin as well, and I can further add that

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it is also fairly common on the hills in both the States up to at least 5,000 ft. elevation, and possibly goes higher. It affects light deciduous jungle with tall grass and scrub undergrowth. Babool and scrub-and-bush jungle, rubber plantations and the neighbourhood of cultivation all provide suitable haunts, but as a rule evergreen forest is eschewed.

The stomachs of the specimens contained caterpillars, grasshoppers, lizards and their eggs, and also other insect remains which could not be satisfactorily identified. The intestines of one were infested with Cestode worms, a number of which have been preserved for identification.

In the Palni Hills, Fairbank (*S.F.*, v, 397) records the Crow-Pheasant from the base up to an elevation of 5,500 ft. In Ceylon it is found throughout the low country and also up to about 3,000 ft. in the hills. A closely allied species, *Centropus chlororhynchus*, also occurs in the island where it is said to be confined to the most humid districts, inhabiting deep jungle with thick tangled undergrowth.

Breeding: Of the specimens, No. 1031 (28 December) was ready to lay shortly, having a matured ovary with some of the follicles measuring over 3 mm. in diameter. No. 349 (24 February) with ovarian follicles ca. 2.5-3 mm., was evidently also preparing to breed. It was undergoing general moult—body, wings and tail—which was presumably prenuptial? In specimen No. 537 (8 April) the testes appeared to have commenced developing (?) and measured 5 × 3 mm. One of them was the normal oval, the other conspicuously kidney-shaped.

On 11 April (Cape Comorin) Humayun took a nest containing three well-set eggs. It was a large globular structure, about 12 in. in diameter, composed of strips of *Borassus* palm leaves and grass etc. placed amongst the tangle of the smaller inaccessible twigs of a thorny Babul (*Acacia*) tree, in low canopied Babul jungle. The eggs measured 37 × 30, 37 × 32 and 36 × 30 mm. respectively. During the week some half dozen recently disused nests were found in this locality, identical in structure and situation with the first and all about 12 ft. up. One contained an addled, discoloured egg.

In the Maharaja's College Museum, Ernākulam, I have seen a juvenile specimen with a stub tail, evidently hatched out in or about November.

According to the *Fauna* (iv, 193) Kinloch took eggs in the Nelliampathy Hills in early March, and Bourdillon says that they continue to lay in Travancore up to the end of August.

Centropus bengalensis (Gmel.) subsp.? The Lesser Coucal or Crow-Pheasant.

Specimen collected: 385 ♀ 1-3-33 Kūmili 3,000 ft.

Elsewhere noted at: Thattakād (200 ft.); Camp Derāmalai (3,000 ft.).

Colours of bare parts: Iris fine outer ring creamy white, irregular inner ring chestnut-brown; bill upper mandible pale brown, culmen dark brown, lower mandible pale flesh colour; mouth pink; legs and feet slaty; claws horny-brown.

[The specimen, ♀ immature, measures:

Bill.	Wing.	Tail.	Tarsus.
29.5	173	209	42.5 mm.

See Eastern Ghats Survey Report (*J.B.N.H.S.*, xxxvii, 528) to which I have nothing further to add as no other material is yet available.—H. W.]

This Coucal frequents stretches of tall grass land intermingled with fairly open deciduous secondary and scrub jungle in the hills of Travancore and probably also Cochin, where, however, neither the Survey nor Kinloch actually came across it. It is not uncommon though rather locally and patchily distributed. Single birds were usually met with. The specimen was scuttling on the ground through the rootstocks of the long grass, and was shot in the act of swallowing a *Calotes* lizard 8 in. in length, head foremost.

This species has not been recorded in the Palni Hills. The only record for Ceylon is possibly not authentic.

Breeding: The ovary of the specimen was undeveloped. No other relevant data was obtained, and there seem to be no published records of its nesting in the Travancore-Cochin area.

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SUB-ORDER: PSITTACI.

FAMILY: PSITTACIDÆ.

[**Psittacula eupatria eupatria** (Linn.). The Large Ceylonese Parroquet.

Not met with by the Surveys nor recorded previously by the older observers in the Travancore-Cochin area. The *Fauna* (iv, 198), however, states that Stewart obtained it in Travancore, and further adds (p. 199) that the birds have been found breeding there in January and February. Confirmation is desirable.]

Psittacula krameri manillensis (Bechstein). The Rose-ringed Paroquet.

Specimen collected: 622 ♂ 18-4-33 Arāmboli 250 ft.

Elsewhere noted at: Kūmāragām (Vembanād Lake, near Kōttayam); Wadakkāncheri (400 ft.); Nemmāra (300 ft.).

Colours of bare parts: Iris pinkish cream colour; rim round eyes (eyelids) bright orange; bill upper mandible deep crimson, tip brownish, lower mandible horny black, crimson at chin; legs and feet dusky yellow; claws horny brown.

[Additional specimens seen:

Brit. Mus. Coll.: ♀ 16-11-78 Trivandrum (Bourdillon); also 2 Fry specimens with no precise data.

Measurements:

	Bill (from cere).	Wing.	Tail.
3 ♂♂	22-24	159-167	210-214 mm.

There is no spring moult and the post-nuptial moult is complete taking place about May and June. The young male is quite indistinguishable from the adult female and I suspect that the juvenile plumage is kept through the first winter.—H. W.]

My experience in Travancore does not bear out Ferguson's statement (*J.B.N.H.S.*, xv, 666) that the Rose-ringed Paroquet is 'very common throughout the low country'. On the contrary, the Survey found it decidedly *uncommon* and only in small numbers wherever occurring. In the low country of Cochin its numerical status was somewhat better, but even so the species was markedly less abundant than the Blossom-headed Paroquet.

Small parties of these birds were observed among cocoanut plantations bordering paddy-fields by the backwaters, and occasionally also in the neighbourhood of villages in the low country.

Fairbank (*S.F.*, v, 395) writes that it is common round the base of the Palni Hills and sometimes ascends the hillsides, while Terry (*S.F.*, x, 471) found it on the slopes below Pulungi. It is a common resident species in Ceylon.

Breeding: The testes of the specimen were in a quiescent state. According to Ferguson the breeding season in Travancore is February and March.

Psittacula cyanocephala cyanocephala (Linn.). The Western Blossom-headed Paroquet.

Specimens collected: 378 ♂ 28-2-33 Kūmili 3,000 ft.; 724 ♂ 26-7-33, 742 ♀ 29-7-33 (Kūttāni 300 ft.); 761 ♀ ?-8-33 (Mārūthānkūzhi 50 ft.) Trivandrum Environs.

Elsewhere noted at: Marāiyūr (3,500 ft.); Thattakād (200 ft.); Kōttayam (ca. S.L.); Periyār Lake Environs (ca. 3,000 ft.); Rājampāra (1,350 ft.); Tenmalai (500 ft.); Trivandrum Town; Kodaiyār Lake Environs (below Balamore Estate); Chālakūdi; Wadakkāncheri (400 ft.).

Colours of bare parts: *Adult Male*: Iris yellowish-white; bill upper mandible pale orange-yellow, lower mandible blackish-brown except chin which pale flesh colour; legs and feet greenish-grey; claws horny plumbeous. *Female*: 'Bill pale lemon yellow, white at tip. Lower mandible dull whitish-grey' (Pillai).

[The specimens are in too bad a state with moult for measurements.

The adults have a complete post-nuptial moult and apparently no spring moult. The juvenile plumage appears to be kept through the first winter. In

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this the male and female are alike with a greenish head and no pale neck-ring. The plumage is in general duller than in the adult, with the central tail-feathers shorter and broader. The tips of the primaries are more pointed than in the adult.

The adult female differs from the adult male not only in the colour of the head and the neck-ring, but the crimson shoulder-patch is absent and the central tail-feathers are a less intense blue.—H. W.]

The Blossom-headed Paroquet is a common resident species in Travancore and Cochin, being found in well-wooded country from the neighbourhood of the backwaters, through the foothills, and up to an elevation of 3,500 ft. at least. In the hills, however, its distribution is somewhat capricious, the birds being quite inexplicably absent from areas to all appearances well suited to them. Thus, though it was fairly abundant at Kūmili, the Survey failed to note it at Peermade, Sānthanpāra or Camp Derāmalai in all of which localities the Blue-winged Paroquet completely replaced it.

It was mostly observed in deciduous forest or in the mixed type of jungle comprising both deciduous and evergreen elements. Occasionally it entered evergreen jungle to feed on the various species of *Ficus* figs. At Marāiyūr a flock of over 50 birds was seen.

At Thattakād these Paroquets were observed to feed largely on the nectar of *Erythrina lithosperma* and *Bombax malabaricum* flowers. In this quest the flowers are bitten off and dropped to the ground after the nectar has been squeezed out. Unlike other nectar-eating birds, therefore, they play little or no part in cross-pollinating them and their visits to the tree are of a purely destructive nature. Among their accustomed haunts are the mixed fruit gardens surrounding the homesteads along the backwaters. Mr. Pillai's notes suggest that they are destructive to standing paddy crops in the environs of Trivandrum.

In the Palni Hills both Fairbank and Terry describe this species as common. According to the former (*S.F.*, v, 395) it is commoner on the hillsides up to 4,000 ft. than the Rose-ringed Paroquet. Terry found it constantly feeding on the peaches in the orchards at Pulungi.

This Paroquet is locally common in Ceylon.

Breeding: The gonads of the specimens were inactive and no other evidence bearing on this aspect was obtained by the Surveys. The July-August specimens, however, were undergoing complete post-nuptial moult.

According to Ferguson (*J.B.N.H.S.*, xv, 666) it breeds in Travancore in March. In South India generally, the breeding season is said (*Fauna*, iv, 205) to be February to early April.

Psittacula columboides (Vigors). The Blue-winged Paroquet.

Specimens collected: 406 ♀ 3-3-33 Kūmili 3,000 ft.; 435 ♂, 436 ♀ 10-3-33 Camp Derāmalai 3,000 ft.

Elsewhere noted at: Marāiyūr (3,500 ft.); Sānthanpāra (3,500 ft.); Thattakād (200 ft.); Peermade (3,200 ft.); Rājampāra (1,350 ft.); Tenmalai (500 ft.); Balamore Estate (2,000-3,500 ft.—Ashāmbū Hills); Kūriārkūtti (1,600 ft.); Pādagiri (3,000 ft.).

Colours of bare parts: *Male*: Iris pale golden yellow; bill upper mandible bright cherry red except tip which yellowish-horn colour, lower mandible horny brown tinged with orange at chin yellowish-horn at tip; legs and feet greenish-grey; claws dark horny brown. *Female*: Iris pale lemon yellow; bill dark horny-brown tinged with orange at chin; legs, feet and claws as in ♂.

[Additional specimens seen:

Brit. Mus. Coll.: ♂♀ ?-3-75 Eridge (Hume Coll.); ♂ 7-1-72 Ashambo Hills (Bourdillon); ♂o? 19-2-14 Aneichardi Estate (Stewart); ♂ 11-11-79, ♀ 8-11-78, ♂ 18-10-78 Mynall (Bourdillon).

B.N.H.S. Coll.: ♂ 19-8-93 Thēkadi (J. P. Cook).

Measurements:

	Bill (from cere).	Wing.	Tail.
6 ♂♂	22-23.5	142.5-148	206-227 mm.
1 ♀	21	135	Worn.

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The adult female differs from the adult male in having the green wash on the forehead and lores reduced to a minimum; there is no ring of verditer green behind the black neck-ring; the grey of the breast is less pure in tint. In the juvenile plumage the male and female are alike. They differ from the adults in having the entire head, hind-neck, mantle and lower parts green, with the neck-rings only faintly shadowed in verditer and black. There is less blue in the green of the scapulars, wing coverts and tertiaries and the pale edging to the wing-coverts is less defined. The central tail feathers are shorter and broader. Both sexes do, I believe, have orange and red beaks, not black as in the adult female.—H. W.]

The Blue-winged Paroquet is common in Travancore and Cochin, but confined exclusively to evergreen biotope. It is most abundant in the hills between about 1,500 and 3,500 ft. elevation, and Ferguson (*J.B.N.H.S.*, xv, 666) records it at 5,000 ft. in the High Range.

At Kūriārkūtti in the Annemalai Hills, small parties of 3 or 4 birds were not uncommon in the mixed bamboo and deciduous jungle on the verge of evergreen. In its accustomed habitat-type, however, it is usually, if not invariably, the only species of paroquet to be met with. It has a call of two harsh notes, somewhat like those of the Paradise Flycatcher (*Tchitrea*) but much louder. I frequently observed it feeding on the nectar of flowers of *Erythrina lithosperma* and *Grevillea robusta* shade trees in Coffee plantations in the usual destructive manner of paroquets.

Both Fairbank and Terry record it from the slopes of the Lower Palnis where it is apparently common. It does not occur in Ceylon.

Breeding: Specimen No. 406 (5 March) had a conspicuously granular ovary, though in plumage it is not fully adult. In No. 435 (10 March) the testes measured 6 × 4 mm. Both these birds as well as the third—with inactive ovary—were undergoing body and primaries moult (post-nuptial ?) and may have lately finished breeding. At this season, however, the birds were mostly observed in pairs, and some of them at any rate were undoubtedly breeding.

F. W. Bourdillon writes (*S.F.*, iv, 388) that this paroquet commences to lay in the first week of January, and fresh eggs (normally c/4) may be obtained in February. The site chosen is invariably a hole in a tree, usually the Iron-wood tree (*Mesua ferrea*) at a height of 16-100 ft. from the ground (T. F. Bourdillon, *J.B.N.H.S.*, xv, 666).

According to the *Fauna* (iv, 209) Bourdillon and Stewart found this species breeding in Travancore during January, February and March.

Coryllis vernalis rubropygius Stuart Baker. The Malabar Loriquet.

Specimens collected: 77 ♂ 13-1-33 Marāiyūr 3,500 ft.; 138 ♂ 24-1-33 Sānthanpāra 3,500 ft.; 205 ♂ 3-2-33 Thattakād 200 ft.; 743 ♀ 29-7-33 (Kūttāni ca. 300 ft.), 849 ♂ 13-8-33 (Nettayam ca. 200 ft.) Trivandrum Environs.

Elsewhere noted at: Kōttayam (ca. S.L.); Peermade (3,200 ft.); Kūmili (3,000 ft.); Camp Derāmalai (3,000 ft.); Rājampāra (1,350 ft.); Tenmalaī (500 ft.); Balamore Estate (2,000 ft.); Kodaiyār Lake Environs (South Travancore); along Cochin Forest Tramway, near Chālakūdi; Kūriārkūtti (1,600 ft.); Wadakkāncheri (400 ft.); from 1,500 ft. upwards along the ghat road from Nemmāra to Pādagiri 3,000 ft.—not below.

Colours of bare parts: Iris brownish-buff or greyish-khaki ('grey'—Pillai); bill reddish-orange; feet pale orange; claws horny brown.

[See my note on this form in the Eastern Ghats Survey (*J.B.N.H.S.*, xxxvii, 754).

The Survey specimens measure:

	Bill (from cere).	Wing.	Tail.
4 ♂♂	11-12	91.5-96	39.5-44 mm.
1 ♀	11.5	97.5	48 mm.

Additional specimens seen:

Brit. Mus. Coll.: ♂ 21-12-74, ♂♀ 16-12-78, Mynall (Bourdillon),—H. W.]

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The Malabar Loriquet is a fairly common resident species in the Travancore-Cochin area, being found in well-wooded country from the neighbourhood of the backwaters, through the foothills, up to an elevation of 3,500-4,000 ft. and occasionally perhaps higher. It frequents secondary jungle, coffee and rubber plantations and the fruit gardens that commonly surround the homesteads along the backwaters. I believe it is to some extent locally migratory, its movements depending upon the flowering of certain trees and the ripening of the fruit of others—or, essentially, upon the availability of a food supply.

Its diet consists of Peepal and Banyan figs (*Ficus religiosa* and *F. bengalensis*) in addition to other fruits and berries both wild and cultivated. At certain seasons it lives largely or almost exclusively upon the nectar of flowers. It is also very fond of the exudation from the base of the petioles of the various Fici. *Erythrina lithosperma* shade trees in bloom in an abandoned rubber estate at Thattakād were observed to be literally swarming with these birds, who fed on the nectar all day long but more particularly in the morning and forenoon. Unlike the paroquets, they do not as a rule destroy the flowers in their efforts to get at the nectar, and consequently are of service in cross-pollinating them. A specimen shot off the blossoms had a quantity of pollen adhering to its chin and over a tablespoonful of nectar dripped from its bill when the bird was held up by a leg. It was noted that very few Loriquets resorted to the profusion of *Bombax malabaricum* flowers on a nearby tree although these were well-patronised by numerous other species. Their preference for *Erythrina* nectar is marked. The birds were also observed on occasion eating nectar from *Loranthus* (*loniceroides*?) buds. The technique in this case is to bite into the tubes near their bases, and thus they seem to be of no consequence in the fertilisation of the flowers of this parasite.

One of the specimens, when shot, clung to its perch head downward and was fluttering when a Tree Pie stooped on it from a neighbouring tree and seized it in a determined attempt to carry it off!

In the Palni Hills, Fairbank (*S.F.*, v, 395) observed this Loriquet at the eastern base and Terry (*S.F.*, x, 471) in the Pittur Valley.

The maximum wing measurement of 88 mm. given for this race in the *Fauna* (iv, 218) is surely a mistake. See measurements of the series supra.

In Ceylon it is replaced by *C. beryllinus*, a species of which Mr. Whistler believes (*J.B.N.H.S.*, xxxvii, 755) that *vernalis* may ultimately prove to be a race.

Breeding: The testes of No. 138 (24 January) measured 3 × 2 mm. and appeared to be developing. The gonads of the other specimens furnished no clue in this regard, and no other evidence was procured by the Surveys.

Bourdillon (*Nidification*, iii, 386) found a nest with c/3—hard set—on 15 March, and Stewart took another c/3 in Travancore on 6 January. The nest in the former case was at the top of a hollow stump over which a creeper was growing to form a sort of cover. It was about 15 ft. from the ground and at an elevation of 2,000 ft. (*J.B.N.H.S.*, xv, 666).

SUB-ORDER: CORACII.

FAMILY: CORACIIDÆ.

Coracias benghalensis indica Linn. The Southern Indian Roller.

Specimens collected: 474 ♀ 20-3-33 Rājampāra 1,350 ft.; 680 ♂ 16-7-33, 837 ♀ 12-8-33 Beach, Trivandrum; 937 ♀ 4-12-33 Nemmāra 300 ft.

Elsewhere noted at: Marāiyūr (3,500 ft.); Sānthanpāra (3,500 ft.); Thattakād (200 ft.); Kūmili (3,000 ft.); Wadakkāncheri (400 ft.).

Colours of bare parts: Iris yellowish-brown or hazel brown; eyelids dusky orange yellow; bill brownish-black paler at gape and base of lower mandible; legs and feet dusky orange-yellow; claws black.

[Measurements:

	Bill.	Wing.	Tail.
1 ♂	49	180	moult.
3 ♀♀	43-43.5	171.5-181.5	109-124.5 mm.

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The juvenile differs from the adult in the paler blue of the abdomen and the absence of any purple wash on the chin and throat. The tail-feathers are much narrower, the outer pair being much more rounded at the tips.

The post-nuptial moult is complete and there is apparently no pre-nuptial moult.—H. W.]

Concerning Travancore, Ferguson (*J.B.N.H.S.*, xv, 657) says: 'The Indian Roller is found in the low country . . . . It is not found in forest nor on the hills.' My own experience shows that while this statement is partly correct, it is by no means a wholly accurate description of the bird's status. The Surveys came across the Roller fairly commonly in the low country, but more sparingly and locally also at elevations up to 3,500 ft. in the hills. It frequents open cultivated country and 'toungya' clearings in deciduous or secondary mixed forest, usually in pairs. Elwes (*Ibis* 1870, p. 526) also met with it in the Cardamom Hills.

In the Palnis it appears to be sparingly distributed. Terry (*S.F.*, x, 471) observed it on one or two occasions in the Pittur Valley. Its occurrence in Ceylon is local.

Breeding: Specimen No. 937 (4 December) had a clearly granular ovary with the follicles apparently maturing. In that of No. 474 (20 March) some of the follicles measured over 1.5 mm. in diameter and it had a distended oviduct indicating that the bird had laid. From the beginning of March the noisy aerial displays of the male were much in evidence, and the birds were apparently breeding on the above date. The July-August specimens had finished breeding. Their gonads had reverted to normal quiescent condition and No. 680 was undergoing complete post-nuptial moult.

According to *Nidification* (iii, 390) Bourdillon took a c/4 in Travancore on 14 April.

Eurystomus orientalis (Linn.). The Broad-billed Roller.

Specimens collected: 236 ♂, 237 ♂ 7-2-33 Thattakād 200 ft.

Elsewhere noted at: Kūriārkūtti (at 2,000 ft.—Annemalai Hills).

Colours of bare parts: Iris brown; bill orange-red, tip blackish-brown; palate and gape pale sulphur yellow, gullet greyish-pink; legs and feet orange-red or coral-red; claws blackish-brown.

[Additional specimens seen:

Brit. Mus. Coll.: ♂? 21-12-72 Eridge (Bourdillon). Type of *lactior* Sharpe; ♂ 16-8-71 Ashāmbū Hills (Hume Coll.).

Measurements:

	Bill.	Wing.	Tail.	Tarsus.
4 ♂♂	34.5-35.5	195.5-198	102-105	18.5-20.5 mm.—H. W.]

The Surveys came across the Broad-billed Roller exclusively in evergreen forest biotope in Travancore and Cochin. It is an uncommon species and not numerically abundant anywhere. At Thattakād it was partial to the neglected overgrown rubber plantations and clearings for *Bombax* and paddy cultivation in evergreen forest. The birds—usually single or pairs—were observed perching hunched up on the leafless topmost branches of some lofty tree towering above the forest, uttering a harsh *chack-chack* every second or two, alternated from time to time by a quicker repeated *chuck-chuck-chuck-chuck* in the same harsh tones. Occasionally they launched sallies after winged insects, performing curious evolutions in mid-air in the pursuit.

Bourdillon (*J.B.N.H.S.*, xv, 658) believed that the Broad-billed Roller was only a breeding visitor to Travancore. Confirmation is desirable, but it is not known precisely on what grounds his presumption is based, and in my opinion Mr. Whistler's doubt as to its correctness (*J.B.N.H.S.*, xxxvii, 756) is well justified.

Breeding: The gonads of the specimens were inactive and furnished no indication as regards breeding. Both the birds, however, appeared to be completing moult (pre-nuptial?) into fresh plumage.

F. W. Bourdillon took eggs on 17 April, and another clutch on 18 April. A full clutch is said to consist of 3 or 4 eggs, generally the latter. The brothers Bourdillon give the breeding season in Travancore as September to May (*Nidification*, iii, 392).

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Family: Meropidæ.

Merops orientalis orientalis Latham. The Common Indian Bee-eater.

Specimens collected: 270 ♂ 11-2-33 Thattakād 200 ft.; 583 naked chick (in alcohol) 12-4-33 Cape Comorin ca. S.L.; 602 ♀ 16-4-33 Arāmboli 250 ft.; 677 ♀ imm. 16-7-33, 838 ♂ 12-8-33 (Beach), 729 ♀ 26-7-33, 824 ♂ 10-8-33 (Kūttāni ca. 300 ft.) Trivandrum Town and Environs; 898 ♀ 24-11-33 Wadakkāncheri 400 ft.; 952 ♀ 7-12-33 Nemmāra 300 ft.

Elsewhere noted at: Marāiyūr (3,500 ft.); Kōttayam and Vembanād Backwaters; Chālakūdi; Trichūr; Karūpadanna.

Colours of bare parts: *Adult*: Iris claret or crimson ('brownish-red' Pillai); bill brownish-black; mouth pink; legs and feet yellowish-brown; claws horny brown.

[Measurements:

	Bill.	Wing.	Tail.
3 ♂♂	30.5-32.5	93-95	112.5-117 mm.
5 ♀♀	30-32	92-93.5	84.5-104 mm.

The post-juvenal moult is complete. There is no spring moult and the post-nuptial moult is complete. Wear turns many of the green feathers blue, especially the tertiaries.

As a whole the Travancore series cannot be distinguished from the typical race, but a few specimens approximate to the richer colour of *M. o. birmanus*, as described in the Eastern Ghats Survey (*J.B.N.H.S.*, xxxvii, 756).—H. W.]

This small Bee-eater is a very common resident species in the low country of Travancore and Cochin. The Surveys did not come across it above an elevation of about 400 ft. except at Marāiyūr where, however, it was uncommon. Its altitudinal status in Travancore seems rather curious in view of the fact that in the Nilgiris it is said to ascend the hills up to 6,000 ft.

The birds frequent open sparsely scrubbed country, the outskirts of light secondary deciduous forest, and the neighbourhood of cultivated and fallow fields, by the backwaters as well as farther inland.

At Thattakād, in an open forest clearing for the Government *Bombax* plantation, this species was found in association with the Blue-tailed and the Chestnut-headed Bee-eaters.

Fairbank (*S.F.*, v, 394) found it common at the base of the Palni Hills and in the adjacent plains, and Terry (*S.F.*, x, 470) saw several in the Pittur Valley [elevation?].

The same, typical, race is common in the drier parts of Ceylon.

Breeding: On 1 January (1934—Karūpadanna) a pair were observed in copula on a telegraph wire at about 7 o'clock in the morning. The ♀ crouched and shivered in invitation to the ♂. Specimen No. 270 (11 February) had testes enlarged to 5 × 3 mm. and was evidently getting ready to breed. On 12 April (Cape Comorin) a nest tunnel, ca. 3 ft. long, was dug out in the side of a laterite and moorum borrow-pit. It contained two chicks just hatched out and 4 very hard-set eggs on the point of hatching. The latter measured: 19 × 17, 19 × 18, 20 × 17, 20 × 18 mm. respectively. Remains of hymenopterous insects were discovered within the tunnel. The specimen of 16 July was immature with an imperfectly ossified skull, the 3 other July-August specimens being adult with gonads reverted to non-breeding condition, and all in heavy post-nuptial moult.

From the data procured it is evident that, as in many other Travancore birds, the breeding season of the Bee-eater commences considerably earlier in this area than has been recorded elsewhere in its range.

Merops superciliosus javanicus Horsfield. The Blue-tailed Bee-eater.

Specimens collected: 226 ♀ 6-2-33 Thattakād 200 ft.; 902 o? 25-11-33 Wadakkāncheri 400 ft.; 1043 ♀, 1044 ♂ 30-12-33 Karūpadanna ca. S.L.

Elsewhere noted at: Kōttayam and Vembanād Backwaters; Chālakūdi.

Colours of bare parts: Iris claret coloured or crimson; bill horny-black; mouth pale pink; legs and feet pinkish-brown; claws blackish-brown.

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[Measurements:

	Bill.	Wing.	Tail.
1 ♂	48	135	141 mm.
2 ♀♀	44.5-46	129-129.5	135-136 mm.

There is apparently no spring moult and the post-nuptial moult is complete. The post-juvenal moult appears to be complete but a good deal delayed.—H. W.]

The Blue-tailed Bee-eater is an uncommon, patchily and sparsely distributed species in the Travancore-Cochin low country. We have no information concerning its status here, but as in many other parts of its range, it may possibly be locally migratory. The Surveys recorded it only between 10 November and 17 February. Ferguson (*J.B.N.H.S.*, xv, 658) mentions that the only specimen in the Trivandrum Museum in his day was one shot near Trivandrum in August 1893. Kinloch (*J.B.N.H.S.*, xxvii, 942) describes it as very common on the northern slopes of the Nelliampathy Hills, but to what elevation or at what season he does not say. The Cochin Survey failed to come across this Bee-eater on the northern slopes of these hills, from Nemmāra at the base up to Pādagiri (3,000 ft.), between 3 and 21 December (1933) although the Chestnut-headed species was noted on the lower slopes.

It frequents more or less the same type of terrain as the Common Bee-eater, but seems to prefer slightly better wooded facies, and usually the neighbourhood of water. Along the Vembanād Backwaters it was noted as commoner and more abundant than the foregoing species. In the forest clearing for the Government *Bombax* plantation at Thattakād, these Bee-eaters were observed in association with *M. orientalis* and *M. leschenaulti*. A small flock was also seen bathing in a still pool in the Periyār River by taking flying dips into the water, after which the birds settled on trees on the bank, shuffled their plumage and dried themselves.

The stomachs of Nos. 1043 and 1044 were crammed full of Blue-bottle flies *Musca* (*vomitoria*?) which were swarming about the 'Kopra' being sun-dried everywhere along the backwaters.

In the Palni Hills, Fairbank (*S.F.*, v, 394) found this Bee-eater abundant by the town of Palni, near the north base of the hills, in October 1866, but on a subsequent visit [month ?] he saw it only once at Periūr. It is a winter visitor to Ceylon.

Breeding: The ovary of No. 226 (6 February) was slightly granular, but the gonads of the other specimen were inactive and no other data in this regard was obtained.

There is no published record of its breeding in Travancore or Cochin.

Merops leschenaulti leschenaulti Vieillot. The Chestnut-headed Bee-eater.

Specimens collected: 209 ♀ 3-2-33 Thattakād 200 ft.; 738 ♀ 29-7-33 Kūttāni 300 ft., Trivandrum Environs; 965 ♀ 10-12-33 Nemmāra 300 ft.

Elsewhere noted at: Sānthanpāra (3,500 ft.); Kūmili and Periyār Lake Environs (3,000 ft.); Camp Derāmalai (3,000 ft.); Kūriārkūtti (1,600 ft.); in forest along Cochin Forest Tramway, from Parambikolam to Chālakūdi.

Colours of bare parts: Iris crimson; bill horny black; mouth greyish-pink; legs, feet and claws blackish-brown.

[Measurements:

	Bill.	Wing.	Tail.
3 ♀♀	35-39	101.5-107	77.5-80 mm.

The post-nuptial moult is complete, and there is apparently no spring moult.—H. W.]

The Chestnut-headed Bee-eater is restricted to forested country in the hills as well as lower down. The Surveys came across it from 200 up to 3,500 ft. elevation. Ferguson (*J.B.N.H.S.*, xv, 558) found it not uncommon about Peermade and in the High Range in North Travancore, but wrongly considered it as confined to the hills only. It is, however, true that on the forested hills this species occurs to the exclusion of the two foregoing.

The birds were observed in pairs, small parties or fairly large flocks, perched on bare branches of tall trees at the edge of forest whence they

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launched aerial sallies after winged insects. At Sānthanpāra (27 January) a flock of over 30 birds was observed roosting in a tree in open jungle at sunset. Much noise and flying around in a rabble prevailed before darkness set in and the birds finally retired.

In the Palni Hills, Fairbank (*S.F.*, v, 394) found the Chestnut-headed Bee-eater plentiful on the eastern side of the hills at between 2,000 and 3,000 ft. in 1866, but in a subsequent year [months?] only saw it once. Terry (*S.F.*, x, 470) met with several birds in the Pittur Valley.

It is a local resident in Ceylon.

Breeding: The ovary of No. 209 (3 February) was conspicuously granular and showed signs of maturing. No other data was procured except that the specimen of 29 July was undergoing complete post-nuptial moult and had probably lately finished breeding.

According to Ferguson, the breeding season in Travancore is in February.

Alcemerops athertoni (Jardine and Selby). The Blue-bearded Bee-eater.

Specimen collected: 75 ♀ 12-1-33 Marāiyūr 3,500 ft.

Elsewhere not noted.

Colours of bare parts: Iris bright golden orange; bill horny brown, grey at chin and on basal half of lower mandible; mouth greyish-pink; legs and feet pale yellowish sage-green; claws horny brown.

[Measurements:

Bill.	Wing.	Tail.	Tarsus.
49	136	128.5	16 mm.

Here again I think there is no spring moult and a complete post-nuptial moult.—H. W.]

The Blue-bearded Bee-eater is evidently a rare species in Travancore. Ferguson (*J.B.N.H.S.*, xv, 658) never met with it himself, but included it in his list on the strength of some skins labelled 'Travancore' in the Trivandrum Museum. There is no record of its occurrence in Cochin.

The Survey came across this large bee-eater only at Marāiyūr, where pairs were observed on two or three occasions in the vicinity of dense secondary evergreen growth bordering the nullahs through the terraced paddy-fields. The birds were very shy.

Its harsh guttural *Kūr-r*, *kūr-r-r* notes closely resemble those of the Ceylon Green Barbet before it commences its *kutroo-kutroo* calls, but are somewhat deeper in tone. Its dipping flight likewise is very reminiscent of that bird's.

Fairbank (*S.F.*, v, 394) obtained this species at the head of the Kambam Valley which skirts the Palni Hills along their south-eastern base, in December 1866. He also observed a pair at Periūr on the Lower Palnis, in March. It does not occur in Ceylon.

Breeding: The ovary of the specimen (12 January) showed but little departure from the non-breeding condition, but it presented a suggestively granular appearance. The bird—one of a pair—was shot from a tree overhanging the motor road. Immediately under this tree, in the side of a laterite cutting, was discovered a freshly excavated nest tunnel, for which I have no doubt this pair were responsible.

There is no published record of its breeding in Travancore. In Kanara, Davison took eggs in March (*Fauna*, iv, 243).

Family: Alcedinidæ.

Ceryle rudis travancoreensis Whistler. The Travancore Pied Kingfisher.

Specimens collected: 283 ♂ 15-2-33, 303 ♂ 18-2-33 Vembanād Lake, Kōttayam Backwaters.

Elsewhere noted at: Thattakād (200 ft.—on Periyār River); Chālakūdi; Wadakkāncheri (400 ft.); Nemmāra (300 ft.); Arāmboli (250 ft.).

Colours of bare parts: Iris brown; bill brownish-black, paler at chin; mouth pink; legs, feet and claws brownish-black.

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[Additional specimens seen:

Brit. Mus. Coll.: o? Travancore (Fry) Type; ♀ 16-11-78 Trivandrum (Bourdillon); 4 Anjango birds.

Measurements:

	Bill.	Wing.	Tail.	Tarsus.
3 ♂♂	68-69	133.5-139	67-71	10.5 mm.
1 ♀	70	140	70.5	— mm.

Both the Survey specimens are undergoing a moult—which appears to be a complete post-nuptial moult—in February.—H. W.]

The Pied Kingfisher is a common resident species in both Travancore and Cochin. It is commonest on the backwaters where single birds or pairs may invariably be seen perched upon stakes and dykes, or hovering above the surface of the water and hurling themselves headlong on some unwary fish in their usual spectacular manner. They were also met with on tanks and rivers, but on the latter only where they were placid and smooth running with deep pools here and there. It was absent on the Periyār Lake (3,000 ft.) and appears to be confined to the low country and not to ascend the hills at all.

It has not been noted in the Palni Hills. In Ceylon, the race *C. r. leucomelanura* Reichenb. replaces it.

Breeding: The testes of the specimens measured 6 × 4 and 7 × 5 mm. respectively. Both the birds were undergoing moult which Mr. Whistler considers to be a complete post-nuptial moult. This would indicate that the birds had lately finished breeding, although it must be mentioned that both of them were in pairs and no juvenile or sub-adult birds were observed in their company, or elsewhere on the backwaters, about this date. From the behaviour alone of these pairs, I certainly should have said that the birds were preparing to breed.

Alcedo atthis taprobana Kleinschmidt. The Common Ceylon Kingfisher.

Specimens collected: 281 ♂ 15-2-33 Vembanād Lake, Kōttayam Backwaters; 501 ♂ 27-3-33 Tenmalai 500 ft.; 944 o? imm. 5-12-33 Nenmāra 300 ft.

Elsewhere noted at: Thattakād (200 ft.); Kūmili (3,000 ft.); Camp Derāmalai (3,000 ft.); Chālakūdi; Shōranūr; Wadakkāncheri (400 ft.); Karūpadanna.

Colours of bare parts: *Adult*: Iris brown; bill brown with orange tinge, especially at gape; palate pale coral, gullet pink; legs and feet orange-coral; claws brown. *Immature*: Iris brown; upper mandible dark horny brown, lower mandible dusky orange, browner at tip; mouth pale orange; legs and feet deep dusky orange; claws horny brown.

[Measurements:

	Bill.	Wing.	Tail.	Tarsus.
2 ♂♂	44.5-45	71-73.5	29.5-32	8.5 mm.

Additional specimens seen:

Brit. Mus. Coll.: ♀ 16-11-75 Vellarny, Trivandrum (Bourdillon); ♀ 21-6-77 Vellarny Lake (Hume Coll.); ♂ 12-4-79 Kildonnan (?), Tvr. (Bourdillon); ♂ ?-1-73 Colachul (Bourdillon).—H. W.]

This little Kingfisher is common about the backwaters and by streams, tanks, roadside puddles, flooded paddy-fields and borrow-pits and the like, chiefly in the low country. It is usually seen singly, perched on some stake or stone or a branch overhanging water, jerkily bobbing its head up and down and wagging its apology of a tail in accompaniment. It darts swiftly over the surface of the water from one part of the stream or tank to another, uttering a sharp piping *chi-chee, chi-chee* etc. From time to time it will suddenly drop from its perch and disappear with a splash below the surface of the water presently to emerge with a small fish held crosswise in its bill. With this it will usually fly off at top speed to another perch at some distance where the prey is battered and bolted down head foremost.

Ferguson (*J.B.N.H.S.*, xv, 659) says that it does not ascend the hills, but the Surveys noted it not uncommonly in the environs of Periyār Lake at 3,000 ft. elevation. In the Nelliampathies, according to Kinloch (*J.B.N.H.S.*,

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xvii, 942) it is very rare, the few perennial streams of the plateau country being the only places where an occasional kingfisher may be seen.

All the information we have concerning it in the Palni Hills is that Terry (*S.F.*, x, 471) saw a pair near Goondar stream in the Pittur Valley. It is a common species in Ceylon.

Breeding: The testes of No. 501 (27 March) measured 3 × 2 mm. and appeared to be developing, while the bird was undergoing pre-nuptial (?) moult. No more precise evidence was procured by the Surveys. According to Ferguson, it breeds in Travancore during March.

Alcedo meninting subsp.? The Blue-eared Kingfisher.

Specimen collected: 196 ♀ 31-1-33 Sānthanpāra 3,500 ft.

Elsewhere not noted.

Colours of bare parts: Iris brown; bill upper mandible horny brown, lower mandible brownish-orange; gape and mouth orange-coral; legs, feet and claws orange-coral.

[The specimen measures:

Bill.	Wing.	Tail.	Tarsus.
45	72.5	27.5	8.5 mm.

I have seen no additional specimens since my note in the Eastern Ghats Survey (*J.B.N.H.S.*, xxxvii, 761) was written so can add nothing to what was written there.—H. W.]

Ferguson (*J.B.N.H.S.*, xv, 659) writes that in Travancore this kingfisher (*'beavani'*) is found only in the neighbourhood of the streams at the foot of the hills where it is not uncommon. F. W. Bourdillon (*S.F.*, iv, 383) describes it as occurring, though less abundantly than *Halcyon smyrnensis*, in the same situations as the latter namely among the small patches of paddy cultivation on the banks of the larger streams at the foot of the hills.

Personally I consider this kingfisher rather rare in Travancore and I came across it only this once in the course of the Survey. It was not noted in Cochin. The specimen was a single bird in an Eeta (*Ochlandra travancorica*) thicket growing on the bank of and overhanging a shallow rocky stream through a cardamom shola and, be it noted, at an elevation of 3,500 ft. in the Cardamom Hills.

It is apparently rare in Ceylon also.

Breeding: The ovary of the specimen was inactive. *Nidification* (iii, 409) records that J. Stewart took a clutch of 6 eggs in South Travancore on 17 January.

[**Ceyx erithaca** (Linn.). The Three-toed Kingfisher.

Not met with by the Surveys in Travancore or Cochin, neither recorded thence by Ferguson, Bourdillon or Kinloch. On what authority Travancore has been included in its distribution in the *Fauna* (iv, 261) is not known.]

Ramphalcyon capensis [**gurial** (Pearson)]. The Brown-headed Stork-billed Kingfisher.

Specimens not procured.

Noted at: Sānthanpāra (3,500 ft.); Thattakād (200 ft.—on Periyār and Kandampāra Rivers); Kūmili (3,000 ft.); Tenmalai (500 ft.); Kūriārkūtti (1,600 ft.—Parambikolam River); Wadakkāncheri (400 ft.); Nemmāra (300 ft.); Ernākulam and Karūpadanna (Cochin Backwaters).

This large kingfisher is not uncommon on shady forest streams in both the States and was also met with on irrigation tanks and their channels where thickly lined with *Pandanus*, in well-wooded country about cultivation, and in similar facies by the backwaters. It is a generally distributed species, but nowhere abundant. I cannot confirm Ferguson's statement (*J.B.N.H.S.*, xv, 659) that it is confined to the low country, although perhaps it is commoner in the foothills and to an elevation of about 1,500 ft. Except when coursing up and down a forest stream from one pool to another, this kingfisher is oftener heard than seen. It has a habit of perching on a well-foliaged branch or thicket near or overhanging water and uttering its loud raucous cackling

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laugh. Single birds were usually seen, but occasionally also widely separated pairs.

Fairbank (*S.F.*, v, 394) noted it at the eastern base of the Palni Hills. It is said to occur in Ceylon 'throughout the wetter portions' (*Fauna*, iv, 265).

Breeding: Stewart and Bourdillon took eggs in Travancore in February and March, and the latter also obtained a c/4 on 20 July (*Nidification*, iii, 416).

Halcyon smyrnensis fusca (Boddaert). The Indian White-breasted Kingfisher.

Specimens collected: 71 ♀ 12-1-33 Marāiyūr 3,000 ft.; 698 ♂ 21-7-33 (Beach), 777 ♀ 3-8-33 (Kōvalam ca. 70 ft.), 860 ♂ 15-8-33 (Mārūthānkūzhi ca. 50 ft.) Trivandrum Environs; 997 (not sexed) 20-12-33 Pādagiri, Nelliampathy Hills 3,000 ft.

Elsewhere noted at: Mūnnār (5,000 ft.—High Range); Thattakād (200 ft.); Kōttayam (ca. S.L.); Peermade (3,200 ft.); Kūmili (3,000 ft.); Rājampāra (1,350 ft.), Cape Comorin; Arāmboli (250 ft.); Kodaiyār Lake Environs, South Travancore; Chālakūdi; Kūriārkūtti (1,600 ft.—Parambikolam River); Wadakkāncheri (400 ft.); Shōranūr; Nemmāra (300 ft.); Karūpadanna (ca. S.L.).

Colours of bare parts: Iris brown; bill brownish orange-red to bright deep coral; mouth orange-brick or coral; legs and feet dusky orange to coral red (brighter on hind tarsus and soles); claws blackish-brown.

[Additional specimen seen:

Brit. Mus. Coll.: ♀ 15-4-75 Mynall (Bourdillon).

Measurements:

	Bill.	Wing.	Tail.	Tarsus.
2 ♂♂	58-63	116-117	76-76.5	13-15 mm.
3 ♀♀	58.5-64	120-121	75.5-86.5	14 mm.

There is no spring moult, and the post-nuptial moult is complete.—H. W.]

The White-breasted Kingfisher is the commonest and most widely distributed of the kingfishers in the States of Travancore and Cochin. It is found throughout the low country as well as up to at least 5,000 ft. elevation. Ferguson is again incorrect in precluding it from the hills.

The bird is usually met with singly or in pairs in the neighbourhood of flooded paddy-fields and cultivation, ponds, puddles, kutcha wells and waterlogged borrow-pits, both near and away from human habitations. The trenches dug for irrigating the trees in cocoanut plantations along the backwaters, tenanted by frogs and water-beetles, provide favourite hunting grounds. It is, however, by no means so closely dependent upon water for sustenance as its other relatives are. Frequently it may indeed be found considerable distances away, in light deciduous jungle, where it feeds upon lizards, grasshoppers and other insects. It is perhaps the most catholic of all the Indian kingfishers in its diet, and will eat practically every living thing that can be come by or overpowered.

Fairbank (*S.F.*, v, 394) observed it at Periūr in the Lower Palnis and Terry (*S.F.*, x, 471) near the Goondar stream in the Pittur Valley. It is common in Ceylon.

Breeding: By the middle of February some males had commenced to 'sing' from tree-tops in the morning. This 'singing' is distinct from the occasional and sporadic calling which may also be heard at other times of the year, and to my mind is definitely associated with the approach or progress of the breeding season. For one thing, it is much more regular in its incidence both as regards time and place, being uttered chiefly in the early mornings from some favourite branch near the top of a patricular tree or other exposed perch. The duration of this 'breeding song' is also considerably prolonged. The song itself may be described as a musical twittering scream or laugh, repeated sometimes for over a quarter of an hour. Each 'peal' ends in a detached undertone something like the *pench* of a snipe, audible only at close quarters and caused, I think, by the intake of fresh air after each call.

The gonads of the specimens were in a quiescent state. No other direct evidence as regards breeding was obtained by the Surveys. The specimen of 3 August, however, was undergoing a complete post-nuptial moult.

According to Ferguson (*J.B.N.H.S.*, xv, 659) and F. W. Bourdillon (*S.F.*, iv, 383) it breeds in Travancore in April.

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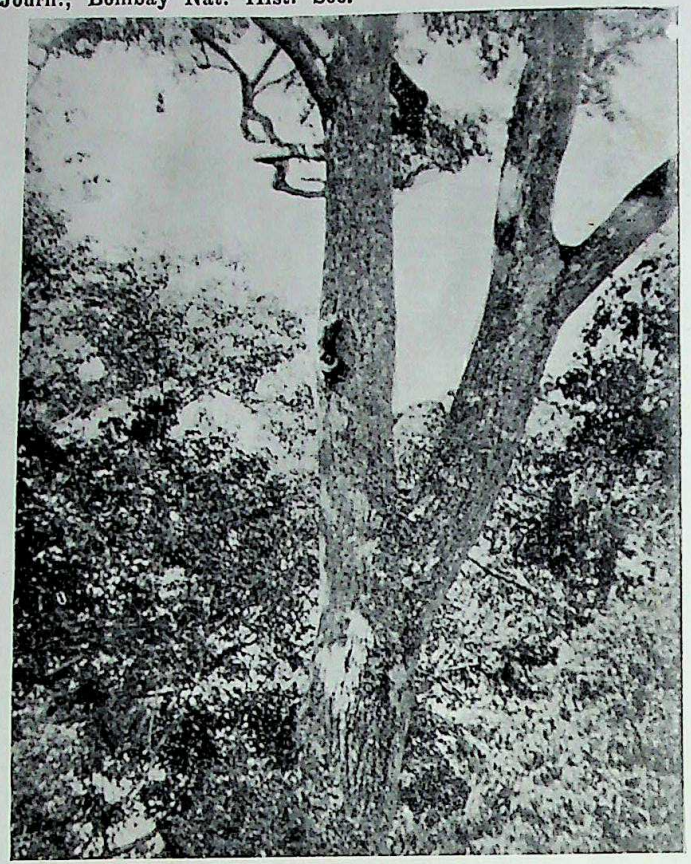
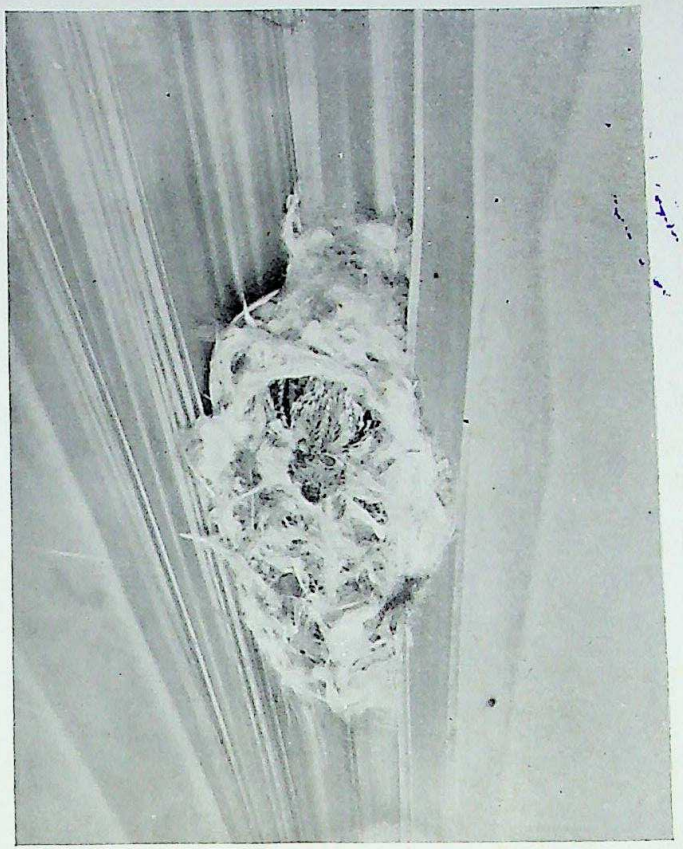


Nest of the Great Indian Hornbill (*Dichoceros bicornis*)—Periyār Lake, 4 March 1933.

Photos by



Nest of Palm Swift (*Cypsiurus p. batassiensis*) in fold of Palmyra leaf. Chick within—Cape Comorin, 8 April 1933.

Sálim Ali.

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Halcyon pileata (Boddaert). The Black-capped Kingfisher.

Specimens not procured.

Noted at: Kūriārkūtti (1,600 ft.—on the Parambikolam River).

This is apparently an uncommon species. Ferguson (*J.B.N.H.S.*, xv, 659) refers to a specimen captured in a well at Trivandrum and brought alive to him, and I observed a single bird near some shallow rapids in the Parambikolam River on 17 November, but was unable to procure it.

It has not been recorded from the Palni Hills being more of a coastal species, but it occurs in Ceylon.

Breeding: *Nidification* (iii, 423) records that J. Stewart took a c/4 from a hole in the bank of a forest stream in Travancore. The precise locality and date are not mentioned.

[**Sauropatis chloris vidali** (Sharpe). The Malabar White-collared Kingfisher.

Not met with by the Surveys in Travancore or Cochin.

According to the *Fauna* (iv, 277) Stewart and Bourdillon both found it in Travancore and 'it appears to inhabit the coastal region from Travancore to Konkan'. However, as Mr. Whistler has pointed out (*J.B.N.H.S.*, xxxvii, 763), no specimens from anywhere south of Ratnagiri apparently exist and further evidence is necessary before the species can be admitted to the Travancore list.]

Family: Bucerotidæ.

Dichoceros bicornis (Linnaeus). The Great Indian Hornbill.

Specimens not procured.

Noted at: Sānthanpāra (3,500 ft.); Thattakād (200 ft.); Kūmili and Periyār Lake Environs (3,000 ft.); Camp Derāmalai (3,000 ft.); Tenmalai (500 ft.); along Cochin Forest Tramway near Kūriārkūtti (ca. 1,000-1,500 ft.); Pādagiri (3,000 ft.—Nelliampathies).

The Great Indian Hornbill is common in the evergreen forest biotope of both Travancore and Cochin, where it was met with chiefly up to about 3,500 ft. elevation. Its deep harsh grunts and croaking, and the loud resonant calls *Tok, tok* etc. were heard reverberating in the forest-clad valleys and hillsides. These calls are responsible for its Malayāli name 'Malāmōrakki' meaning 'mountain-shaking'.

The birds were usually observed in pairs or parties of 3 to 5, but sometimes larger groups foregathered to feed on the ripe figs of the various *Fici*. In January, February and early March it was not unusual to find single males winging their way noisily high up in the air, presumably to and from the nests in quest of forage for their walled-in mates.

Both Fairbank and Terry record it in the Palni Hills, the former from the vicinity of the town of Palni, the latter in the Pittur (Putthur) Valley.

Curiously enough it does not occur in Ceylon, an anomaly which seems worthy of closer ecological investigation.

Breeding: The hillmen who were sent out to reconnoitre, discovered and took me to a nest on 4 March. It was in a hollow in the trunk of a lofty Poon tree (*Calophyllum tomentosum*)—about 50 ft. up—a short distance within primary evergreen forest along a secluded arm of the Periyār Lake. The diameter of the trunk at the nest site was 3½ to 4 ft., and through the narrow slit (about 8 × 2 in.) the hen could occasionally be observed by means of field-glasses, shifting her position (on the eggs ?) within. The plaster around the slit was extraordinarily well camouflaged and blended to perfection with the bark. One of the hillmen who had stayed behind to mark the place, informed me that the cock bird had visited the nest in the morning and fed the hen, but since then—and between 11 a.m. and 2 p.m. while I had it under observation—he remained absent. Finally he arrived with food at 3 o'clock. He was extremely wary and circumspect, alighting in the highest branches of a neighbouring tree and surveying his surroundings with the utmost caution. At 4 o'clock, when I had to leave the place, the bird was still hesitating to approach the nest, his suspicions having doubtless been enhanced by the removal of certain hanging creepers which obstructed the lens of my camera.

The information gathered from the hillmen is as follows: The male usually feeds his incarcerated mate three times a day, each feed occupy-

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15 to 20 minutes. In addition to these, he may pay short visits occasionally to the nest with a lizard or some similar tit-bit. The presence of a nest, even before the eggs have hatched, is usually betrayed by the droppings of the ♂ and fragments of the food he brings, lying on the ground or on bushes beneath the nest site. Whether the female also casts her excreta out through the slit I was unable to ascertain. The number of young are said to be two as a rule. After the young are hatched out, the hen issues forth from her self-imposed imprisonment, the pair visit the nest with food oftener and become very bold, noisy and demonstrative, attacking any person who ventures into the proximity of the nest-tree.

To this I may add that the hillmen esteem the hornbill squabs a great delicacy and seek them eagerly for food. What the true extent of such destruction is, and whether this persecution is having any effect upon the numbers or nesting habits of the bird, it would be interesting to investigate.

T. F. Bourdillon (*J.B.N.H.S.*, xv, 660) obtained an egg at the beginning of March in Travancore where according to *Nidification* (iii, 430) the breeding season is February, March and April.

Hydrocissa coronata (Boddaert). The Malabar Pied Hornbill.

Specimen not obtained.

The Travancore Survey only came across this species once—a flock of 7 birds in lofty tree-tops in heavy evergreen forest at the confluence of the Kandampāra stream with the Periyār River, about a mile below Thattakād.

Ferguson (*J.B.N.H.S.*, xv, 660) describes it as 'by no means common [in Travancore] but locally distributed in forest land at the foot of the hills'. He mentions a specimen in the Trivandrum Museum shot about 9 miles from Trivandrum. As against this, it may be noted that Kinloch (*J.B.N.H.S.*, xxvii, 942) found it 'very common' in the Nelliampathy Hills. The Cochin Survey, however, failed to meet with it in the locality around Pādagiri (3,000 ft.) in December.

Neither Fairbank nor Terry include the species in their Palnis lists. It occurs in Ceylon.

Breeding: *Nidification* (iii, 431) mentions that a single egg with young bird [hard-set?] was taken by Stewart in Travancore on 15 March.

Tockus griseus (Latham). The Malabar Grey Hornbill.

Specimens collected: 120 ♀, 121 ♀ 22-1-33 Sānthanpāra 3,500 ft.

Elsewhere noted at: Rājampāra (1,350 ft.); Tenmalai (500 ft.); Kuvallē Incline—Cochin Forest Tramway; Kūriārkūtti (1,600 ft.); Wadakkāncheri (400 ft.); Pādagiri (3,000 ft.).

Colours of bare parts: Iris brown in 120 (probably first year), reddish-brown in 121; bill in 120 brownish pale yellow, commissure, gape, a patch on each side of base of lower mandible and a triangular patch (ca. ¾ in.) on culmen near forehead brownish-slate; in 121 brownish-slate on culmen extending practically over entire culmen patchily and irregularly; mouth patchy pale yellow and brownish-slate; legs and feet greyish sage-green; claws black.

[Additional specimens examined:

Brit. Mus. Coll.: ♂ 18-2-14, ♀ 20-2-14 Aneichardi Estate (Stewart); ♀ 24-2-70 Cardamom Hills 3,000 ft. (Elwes); ♂ 15-4-75 Mynall (Bourdillon).

I take No. 120 to be a juvenile distinguished by the paler colouration, with a fulvous tinge about the vent. All the wing coverts are conspicuously edged with fulvous while the wing-quills are edged with pale grey except for the outer primaries which are conspicuously marked with white. The tail-feathers are narrower and the primaries more narrowly pointed than in the adult.—H. W.]

The Grey Hornbill is common in the evergreen forest tracts of Travancore and Cochin. I did not observe it below about 400 ft. elevation; it was most abundant in the Cardamom Hills between 3,000 and 3,500 ft. Ferguson (*J.B.N.H.S.*, xv, 660) states that he shot it at over 5,000 ft. on the High Range and at 4,000 ft. on Chimunji in South Travancore. Kinloch (*J.B.N.H.S.*, xxvii, 942) found it 'very common' in the Nelliampathy Hills, and this was also the experience of the Survey in the locality about Pādagiri,

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Its favourite haunts were the lofty shade trees in cardamom *sholas* where flocks of 5 to 6 birds were usually met with amongst the tops of the various *Fici*, feeding on the figs or flying about from one tree to another in follow-my-leader fashion. In such places it was not uncommon to find larger congregations associating with grackles and a number of other frugivorous species. They are rowdy birds and keep up an incessant variety of loud harsh croaks, chuckles and mock laughter, varied now and then by raucous cackling. Several of their harsh screams are strongly reminiscent of the loud protestations of the domestic *murghi* when held up by its legs.

Fairbank (*S.F.*, v, 395) writes that he obtained a specimen of this hornbill at the eastern (dry) base of the Palni Hills in 1867, but did not observe another during five weeks' special search for it on the hillsides and in the groves in a subsequent year. Terry does not include it in his Palni list, all of which suggests that it is rare in those hills.

In Ceylon it is replaced by what must be considered another species rather than race of this, namely *Tockus gingalensis*.

Breeding: The ovarian follicles of No. 121 (22 January) were conspicuously granular, some measuring over 1 mm. in diameter, and the bird was probably approaching breeding condition. *Nidification* (iii, 441) gives the breeding season in Travancore as January to early April, but mentions that most eggs are found in February. According to Bourdillon 3 eggs form a normal clutch, but J. Stewart has apparently taken a good many c/d around Aneichardi.

Family: Upupidæ.

Upupa epops ceylonensis Reichenbach. The Ceylon Hoopoe.

Specimens collected: 42 ♂ 9-1-33 Marāiyūr 3,500 ft.; 546 ♂ 9-4-33, 563 ♂ 11-4-33 Cape Comorin ca. S.L.; 992 ♂ 18-12-33 Pādagiri 3,000 ft.

Elsewhere noted at: Mūnnār (5,000 ft.); Devikolam; Sānthanpāra (3,500 ft.); Thattakād (200 ft.); Peermade (3,200 ft.); Kūmili (3,000 ft.); Camp Derāmalai (3,000 ft.); Tenmalai (500 ft.); Trivandrum Town (ca. 50 ft.); Arāmboli (250 ft.); Ashāmbū Hills (at ca. 500 ft.); Wadakkāncheri (400 ft.); Nemmāra (300 ft.); Trichūr; Ernākulam.

Colours of bare parts: Iris dark brown; bill horny brown or horny black at tip gradually paling into greyish at base; mouth pink; legs and feet horny brown; claws brown.

[The 4 males measure:

Bill.	Wing.	Tail.	Tarsus.
56-62.5	133-136	92-99	21.5-22 mm.—H. W.]

The Hoopoe is a generally distributed species throughout Travancore and Cochin though nowhere abundant. The Surveys came across it sporadically, singly or in pairs, inhabiting the drier and opener parts of the low country as well as hills up to at least 5,000 ft. Ferguson (*J.B.N.H.S.*, xv, 660) writes: 'During the hot weather about March it may be found in the hills even ascending the High Range' which would make it out to be a seasonal altitudinal migrant. Kinloch (*J.B.N.H.S.*, xxvii, 942), however, does not refer to this peculiarity in the Nelliampathies, neither do the Survey dates convey that impression. Unfortunately we have no first-hand data for the hills during the South-West Monsoon season i.e. May to October.

In the low country single birds or scattered pairs were met with about cultivation, villages, in large compounds of the more populous towns and also in light deciduous jungle. In smaller numbers they were occasionally observed in evergreen forest tracts also, both hill and plain, but never actually within forest. In these localities they kept to the deciduous country on its fringe, to the *taungya* clearings or to paths and thinly shaded spaces in tea or coffee plantations.

Fairbank (*S.F.*, v, 399) observed this hoopoe on the Lower Palnis, but particularly mentions that he also shot one specimen belonging to the typical European race, *U. e. epops*, there.

It is a resident but locally distributed species in Ceylon.

Breeding: In specimen No. 992 (18 December) the testes measured 6 × 3 mm. It was one of a pair calling *hoo-po-po* etc. from exposed perches;

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Specimen No. 42 (9 January) also appeared to be similarly preparing to breed. The gonads of the other two specimens were in a quiescent state. On 24 February (Peermade, 3,200 ft.) a bird was observed conveying food in its bill, but the nest was not located.

The *Fauna* (iv, 312) gives the breeding season for South India as February to April; for Ceylon November to April with possibly a second brood later.

SUB-ORDER: TROGONES.

FAMILY: TROGONIDÆ.

Harpactes fasciatus malabaricus (Gould). The Malabar Trogon.

Specimens collected: 8 ♂ 4-1-33 Marāiyūr 3,500 ft.; 214 ♂ 4-2-33, 224 o? 6-2-33 Thattakād 200 ft.; 492 ♂ 26-3-33 Tenmalai 500 ft.; 874 ♀ 16-11-33 Kūriārkūtti 1,600 ft.

Elsewhere noted at: Kūmili and Periyār Lake Environs (ca. 3,000 ft.); Rājampāra (1,350 ft.); Ashāmbū Hills (ca. 2,000 ft.).

Colours of bare parts: Iris dark brown (in ♀ 874 chestnut brown); bill blue, black on culmen and tips of both mandibles; mouth pink; orbital and suborbital skin bright cobalt blue; legs and feet paler blue ('dusky sky blue'); claws horny brown.

[Additional specimens seen:

Brit. Mus. Coll.: ♂ 19-6-77 Shemiganur 5,000 ft.—Palnis (Fairbank); ♂ 4-12-72 Eridge (Bourdillon); ♀ 8-12-74 Mynall (Bourdillon).

Measurements:

	Bill.	Wing.	Tail.	Tarsus.
5 ♂♂	21.5-23	122-128.5	160-179.5	13-15 mm.
1 ♀	20	127.5	166	14.5 mm.—H. W.]

As Ferguson describes it (*J.B.N.H.S.*, xv, 663), this beautiful trogon is not uncommon in the heavily forested tracts of Travancore and also of Cochin. The Surveys came across it both in the plains forests as well as up in the hills —between 200 and 3,500 ft. elevation. It is usually seen singly or in scattered pairs frequenting dense evergreen (or mixed) jungle and undergrowth, flitting about gracefully from branch to branch or tree to tree, or turning and twisting in the air after winged insects like *Tchitrea*. I frequently observed it clinging laterally on to the branches in quest of food. On the whole the birds were silent, but their curious low mewing calls occasionally helped to give their presence away. This trogon is rather crepuscular in its habits and may often be seen actively hawking beetles well after dusk. When perched on a branch, it somehow always contrives to keep the less conspicuously coloured back turned to the observer, which, coupled with its habit of sitting quite motionless, not infrequently helps it to evade observation! Specimen No. 874 emitted an unpleasant odour.

Kinloch (*J.B.N.H.S.*, xxvii, 942) who describes this trogon as common in the Nelliampathy Hills, notices a curious habit it has while perched, of expanding and elevating its tail and uttering a low twittering creak the while. He suggests that this is possibly a courting display.

From Fairbank's account (*S.F.*, v, 393) it would appear that the bird is rather uncommon in the Palni Hills. The typical race *H. f. fasciatus* replaces it in Ceylon.

Breeding: The gonads of the specimens were inactive and furnished no indication as regards breeding. Specimen No. 492 (26 March), however, was undergoing heavy post-nuptial (?) moult.

On 27 April (Ashāmbū Hills, ca. 2,500 ft.) Humayun Abdulali discovered a nest in a dense evergreen *shola* on a hillside, close to the edge. It was an untidy, flimsy platform of rotten twigs etc. slightly cupped in the centre, wedged in at a height of about 8 ft. between a growing sapling and a sweeping cane-stem. It was a disreputable and deserted looking structure, reminiscent of a dove's nest. The two eggs it contained—pale ivory white, unspotted —were well-glossed, and measured 27 × 22 and 27 × 21 mm. respectively. The female, when disturbed off the nest, dived into the undergrowth below

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with a series of *turr-rr* etc. The male sat watching on a huge tree about 20 yds. away.

The above case is interesting and would appear rather exceptional in view of the statement in *Nidification* (iii, 448) that 'For nesting purposes the birds select natural holes in dead trees or more often, in stumps of trees in the gloomiest parts of the forest. . . .'

The breeding season in Travancore is said (ibid) to be from February to May, Bourdillon and Stewart having taken eggs from 29 February to 12 May. The normal clutch is said to consist of 2 to 4 eggs.

SUB-ORDER: CYPSELI.

FAMILY: MICROPIDÆ.

Micropus melba bakeri (Hartert). The Indian Alpine Swift.

Specimen not obtained.

Noted at: Marāiyūr (near Kōdekkadu and Kaipānjimalai 5,000-6,500 ft.); Kōttayam (ca. S.L.); Mūthūkūzhi (Ashāmbu Hills, ca. 4,000 ft.); Pādagiri (at ca. 4,500 ft.—Nelliampathy Hills).

The Alpine Swift is evidently a resident species and not uncommon on the High Range and the other higher hills of Travancore and Cochin. Numbers were usually seen hawking insects over the grassy hilltops or above the intervening valleys. On one occasion a party of these swifts was observed by the Kōttayam Backwaters near Kūmāragam, hawking insects high above the crowns of the cocoanut palms and frequently sweeping down to within a few feet of the water-logged paddy fields.

Ferguson (*J.B.N.H.S.*, xv, 661) shot these birds on the High Range and there saw them in numbers hawking insects through the smoke wherever the grass was being burnt.

In the Palni Hills, Terry (*S.F.*, x, 469-70) found a large number of Alpine Swifts on a cliff near Pittur (Putthūr) where he thought they were nesting. He could not ascertain this owing to the inaccessible nature of the place.

It occurs in Ceylon, but as far as I know has not definitely been found breeding on the island. However, W. W. A. Phillips [*Ceylon Jour. Sci.* (B), xviii, 252] describes what is evidently a breeding place at Rangala. It was inaccessible.

The reports and suggestions of its breeding on the cliffs and precipices about the Gairsoppa Falls on the Mysore-Kanara border have at last recently been confirmed by Humayun Abdulali who saw the birds building, and collected specimens with fully active gonads on 26 December 1935 (*J.B.N.H.S.*, xxxviii, 829-30).

No nesting in Travancore or Cochin has been noted, but in view of the above there seems no reason to doubt its doing so, since suitable cliffs and precipices are available in the Nelliampathies of Cochin and in the High Range and other mountains of Travancore.

Micropus affinis subsp.? The House-Swift.

Specimens collected: 596 ♂ 15-4-33, 619 ♂ 18-4-33 Arāmboli 250 ft.

Elsewhere noted at: Kōttayam (ca. S.L.); Karūpadanna (ca. S.L.).

Colours of bare parts: 'Iris brown; bill black; mouth fleshy; legs and feet fleshy shading into black; claws black' (Humayun and Pillai).

[See my remarks under Eastern Ghats Survey (*J.B.N.H.S.*, xxxviii, 30-32) which explain why these birds cannot be subspecifically named.—H. W.]

On the whole, the House Swift is an uncommon, patchily and capriciously distributed species in the Travancore-Cochin area. It is evidently confined to the low country and does not seem to ascend the hills at all. The Surveys only have the following records:

1. A pair about the Travellers' Bungalow at Kōttayam (February).
2. A nesting colony of about 50 birds in the Arāmboli Gap (April).
3. Two pairs about the Travellers' Bungalow at Karūpadanna (December).

In the last case the birds occasionally visited the remains (or foundation ?) of a nest in the rafters of the verandah. In the evenings it was their habit to disport themselves, flying in close formation in and out of the verandah

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and twittering loudly. The flight on these occasions consisted of a butterfly-like fluttering—wings raised well above the back and only their tips vibrating rapidly.

Ferguson's collectors found a colony breeding in January 1903 in the Registrar's office in North Parur in North Travancore, but he himself never came across this swift in the State (*J.B.N.H.S.*, xv, 661). In the Palni Hills, Terry (*S.F.*, x, 470) found it not uncommon at Pittur and Kukal, but saw it nowhere else. Fairbank (*S.F.*, v, 393) observed a dozen or so hawking insects above the tree-tops at 3,000 ft. elevation. [This or *Indicapus*?]

It occurs in Ceylon, but the birds from the island are darker.

Breeding: Specimen No. 596 (15 April) had its testes enlarged to 6 × 4 mm. It was in general body moult (post-nuptial?) and exceedingly fat. In No. 619 (18 April) the gonads were in a quiescent state. Attached to the ceiling of the projecting section of an enormous boulder hillock on the southern side of the Arāmboli Gap was a colony of about 18 nests, apparently all occupied. Owing to the inaccessibility of the situation their contents could not be ascertained. The birds constantly flew to and from the nests in a body with a great deal of twittering, and kept wheeling round and hawking insects in the neighbourhood.

The breeding months in Malabar and Travancore are said to be the same as in Ceylon, viz., February and March (*Fauna*, iv, 334).

Cypsiurus parvus batassiensis (Griffith). The Bengal Palm Swift.

Specimens collected: 531 nestling, 532 o? ad. 8-4-33, 589 ♂ 13-4-33 Cape Comorin ca. S.L.; 950 o? 6-12-33 Nemmāra 300 ft.

Elsewhere noted at: Kōttayam (ca. S.L.); Trivandrum (ca. S.L.); Wadakkāncheri (400 ft.); Pālghāt Gap; Karūpadanna (ca. S.L.).

Colours of bare parts: *Nestling* (531): Iris brown; bill, legs, feet and claws pinkish-brown. *Adult*: Iris brown; bill dark horny brown; mouth pinkish-grey; legs, feet and claws pinkish-brown.

[Additional specimen seen:

Brit. Mus. Coll.: ♂ 28-2-75 Kolachul (Hume Coll.).

Measurements:

	Bill.	Wing.	Central tail.	Outer tail.
1 ♂	7.5	113	31	65.5 mm.—H. W.]

As elsewhere, the Palm Swift is common in the low and dry country of Travancore and Cochin wherever the Palmyra Palm (*Borassus flabellifer*) occurs. It seems to be definitely symbiotic with it, but what the precise factors are that control this symbiosis have still to be determined.

In the Palni Hills also, Fairbank (*S.F.*, v, 393) observed it about Palmyra trees in Periākulam near the eastern base (dry country). It is common in the plains and low hills of Ceylon in suitable facies.

Breeding: On 8 April (Cape Comorin) a nest was located in a fold or furrow of a Palmyra leaf, about 30 ft. up. The leaf was cut off at the stem and lowered for examination by means of a rope. The nest (see photo) was a tiny saucer of agglutinated feathers, and down and seeds of the *Ak* plant (*Calotropis*). The attachment to the leaf along the rim of the saucer was 110 mm. long, the other measurements being as follows: Width of saucer from side to side 38 mm.; width, back to front 28 mm.; the actual saucer or egg chamber was 10 mm. deep from the rim. The fabric at the bottom was 10 mm. thick; the thickness of the top edge of the rim in front, 1 mm. The nest contained a single chick, naked except for the sprouting feather-tracts and quills. Throughout the rough handling that the leaf received in the hacking and lowering process, when it swayed violently in the breeze, the chick held on tenaciously to the fibrous lining of the nest. This capacity for retaining its hold under turbulent conditions must undoubtedly be of high survival value to the chick during storms.

In the same furrow of the leaf as held the nest, and about 8 in. above it, hung a pipistrelle bat, apparently both the occupants living on amicable terms. The swift and the bat may be considered as filling identical ecological 'niches', but the former is diurnal while the latter does the night shift. A

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detailed ecological study of a Palmyra palm would no doubt yield interesting results.

Specimen No. 532 shot near the nest tree, and presumably one of the parents, was very fat. It had an incubation patch and was moulting its secondaries; its gonads had evidently reverted to normal size, but shot damage made sexing impossible. Its gular pouch was crammed full of flying ants and other tiny hymenopterous insects. No. 589, with testes ca. 3 × 2 mm., had evidently finished breeding. It was undergoing complete post-nuptial moult. In No. 950 (6 December) the gonads were not discernible. It was in freshly moulted plumage (post-juvenal ?).

Apparently no published records of its breeding in Travancore or Cochin exist, but in Ceylon October to April is said to be the season (*Fauna*, iv, 337).

Sub-Family: Chæturinæ.

Chætura giganteus indicus (Hume). The Brown-throated Spinetail.

Specimens collected: 347 ♂, 348 ♀ 24-2-33 Peermade 3,200 ft.

Elsewhere noted at: Thattakād (200 ft.); Camp Derāmalai (Ūppukūlam 3,000-4,000 ft.); Rājampāra (1,350 ft.); Tenmalai (500 ft.); Balamore Estate and Ashāmbū Hills (500-3,500 ft.); Kodaiyār Lake Environs; Kūriārkūtti (at 3,500 ft.—Annemalai Hills); Pādagiri (3,000-4,000 ft.—Nelliampathy Hills).

Colours of bare parts: Iris brown; bill horny-black; mouth greyish-pink; legs and feet greyish-pink; claws horny brown.

[Additional specimens seen:

Brit. Mus. Coll.: ♂ 14-10-76, ♂ 3-11-78, ♂ 5-1-80 Mynall (Bourdillon).

Measurements:

	Bill.	Wing.	Tail.	Tarsus.
4 ♂♂	13.5-16	190-200	56-59	16.5-17.5 mm.
1 ♀	13	195	60	18.5 mm.—H. W.]

This magnificent swift is fairly common and evidently a resident in the hills of Travancore and Cochin. Kinloch's statement (*J.B.N.H.S.*, xxvii, 942) suggests that in the Nelliampathy Hills it is only a cold weather visitor. The Survey also came across it in the low and foothills country at Thattakād in the neighbourhood of fairly heavy deciduous jungle. The range of elevation recorded for it in my notes is 200-4,000 ft. above sea level. Hilltops, both grass-covered and with forest interspersed, are favourite hunting grounds, and in the mornings and evenings numbers of these birds were commonly to be seen swishing through the air majestically over these at tremendous speed, hawking insects and disporting themselves. The ease, grace and swiftness with which they follow the contours of the hilltops or sweep around overhangs is exhilarating to watch.

Bourdillon has an interesting note on this swift in *Stray Feathers*, vii, 34. He says that a flight during the early showers of April is a pretty sure indication of the approach of a storm. What exactly he means by 'flight', however, is not clear. Possibly he refers to the 'balling' as of the Common House Swift.

This species has not been recorded from the Palni Hills either by Fairbank or Terry. In Ceylon, it is resident on the hills.

Breeding: Both the specimens (24 February) were evidently breeding. They were freshly moulted. The testes of the male measured 18 × 5 mm., while the female had a soft ovarian egg and her oviduct was considerably distended. Unfortunately the nest site was not discovered, but there was a deserted factory chimney on a grassy hilltop in the neighbourhood which the birds were observed flying in and out of, and at the bottom of which I suspect they may have been nesting. T. F. Bourdillon (*J.B.N.H.S.*, xv, 661) observed a bird flying with a straw in its bill at the beginning of April, but was doubtful of this species breeding in Travancore.

It was not until 1913 that Mr. J. Stewart—to whom we are indebted for so much recent information on Travancore birds—found this swift roosting and breeding in large hollow green trees (chiefly *Vateria indica*) in the Travancore hills. His note on the subject (*J.B.N.H.S.*, xxii, 393) is so interesting that I quote it *in extenso*. He writes; 'I have on several occasions seen

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colonies of 30-50 birds roosting in trees, but have only just succeeded in finding them breeding. On the 12th instant [March 1913] I discovered a tree in which the birds were popping out and in at the only entrance which was at a height of about 45 ft.; the tree was hollow from top to bottom, and, on cutting a hole in it near the ground I found two nests each containing 2 fresh eggs. The nests were mere depressions in the earth at the foot of the tree with dry leaves and straw. The eggs were pure porcelain white with very hard shells, the average size of the 4 eggs is 1.28 × 1 in. I have since tapped another tree in the same way and found 3 nests at the foot of it; 2 nests were empty and the third contained 2 young birds. All the trees I have seen occupied by this swift have been at elevations of 1,000-2,000 ft. in heavy forest'. Subsequently Mr. Stewart obtained a considerable number of their eggs. Although the birds roost in the hollow trunks, at times in large colonies, he never found more than two pairs breeding in one tree, and usually only a single pair. Three or four eggs form the normal clutch according to him, but he has found as many as 5 eggs in a nest. *Nidification* (iii, 466) adds that the breeding season in Travancore is March and April.

Indicapus sylvaticus (Blyth). The White-rumped Spinetail.

Specimens collected: 228 ♂, 229 ♀ 6-2-33 Thattakād 200 ft.

Elsewhere noted at: Peermade (3,200 ft.); Kūriārkūtti (1,600-2,500 ft.).

Colours of bare parts: Iris brown; bill blackish-brown; mouth greyish-pink; legs and feet pinkish-brown; claws blackish-brown.

[Measurements:

	Bill.	Wing.	Tail.
1 ♂	8	114	37 mm.
1 ♀	7	115	36 mm.—H. W.]

A loose flock of about 20 of these little Spinetails was first observed by the Travancore Survey hawking insects on the right bank of the Periyār River at Thattakād, and above the forest clearing for the government *Bombax* plantation. Subsequently (24 February) twos and threes were seen flying over grassy hills at Peermade. On the evening of 16 November a flock of 15 or more birds were observed disporting themselves in the air on the Parambikolam River at Kūriārkūtti (Cochin) flying over the surface and wheeling round in orderly fashion. The birds utter a twittering *chick-chick* in flight like the Common Swift and their appearance on the wing is also greatly reminiscent of that bird. The above constitute the only records obtained by the Surveys. They indicate that the species is not common in this area, and also somewhat patchily distributed. Ferguson and Bourdillon do not appear to have come across it in Travancore.

There is no record of its occurrence in the Palni Hills. It is not found in Ceylon.

Breeding: The gonads of the specimens (6 February) showed signs of maturing. Both of them, moreover, were in freshly moulted plumage and evidently ready to breed shortly. The testes of the male measured 4 × 3 mm.; the ovarian follicles of the female were .5-1 mm. in diameter.

According to J. Stewart (*J.B.N.H.S.*, xxii, 394) these spinetails breed in the Travancore hills in open forest at elevations of about 2,000 ft., but not in colonies. The nest is made of vegetable fibre strongly attached with saliva to the inside of a hollow tree. *Nidification* (iii, 467) adds that according to the same observer the breeding season in Travancore is March and April, but that a few eggs may be found in the first half of May. The normal clutch is said to be of 3 to 5 eggs.

Collocalia fuciphaga unicolor (Jerdon). The Indian Edible Swiftlet.

Specimen not obtained.

Noted (unconfirmed) only at Tenmalai (500 ft.) on 27 March. Several birds (50-60) hawking insects high above a Teak plantation.

[Travancore specimens seen:

Brit. Mus. Coll.: ♂♂ 18-3-75 Eridge (Bourdillon).

Measurements:

	Bill.	Wing.	Central tail.	Outer tail.
2 ♂♂	8-8.5	115-117	41-44.5	53.5-54 mm.—H. W.]

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Ferguson (*J.B.N.H.S.*, xv, 662) describes this swiftlet as 'Common in the hills [of Travancore] where it is resident' and Bourdillon (*S.F.*, iv, 374) likewise says 'Resident on the hills and very abundant'. In view of these statements it is curious that the Surveys did not come across it more than in the one doubtful instance given. It is indeed surprising that they should have so consistently evaded observation during the seven months spent in famous Pillar Rocks. It is a generally distributed resident in Ceylon.

In the Palni Hills also this swiftlet is apparently common. In about 1886, Terry (*S.F.*, x, 470) saw large numbers flying about over the lake at Kodaikānal. R. Foulkes (*J.B.N.H.S.*, xv, 727) found the same in 1904 and describes how one bird splashed into the water and would have drowned but for his rescue. According to both these observers, it appears that they breed regularly in the Palni Hills, a favourite site being the caves and sides of the famous Pillar Rocks.

Breeding: Bourdillon (*S.F.*, iv, 374-6 and *J.B.N.H.S.*, xv, 662) gives very good accounts of the nesting of this swiftlet in Travancore. According to him, it breeds abundantly throughout the hills, sometimes in small colonies of 4 or 5 pairs, and sometimes in larger colonies of as many hundreds. The largest breeding place he knew of was a cave situated at the base of a grass ridge in South Travancore at about 2,300 ft. elevation. In this he found from two to three hundred nests in March, the greater number containing 2 eggs each. This number in a clutch is said to be almost invariable.

Nidification (iii, 469) gives the breeding season in Travancore as April, May and June.

Sub-Family: Hemiprocninæ.

Hemiprocne coronata (Tickell). The Indian Crested Swift.

Specimens collected: 217 ♀ 4-2-33 Thattakād 200 ft.; 387 ♂ 1-3-33 Kūmili 3,000 ft.; 825 ♀, 826 ♀, 827 ♂, 828 ♂, 829 ♀ 10-8-33 Kūttyāni 300 ft.—Trivandrum Environs; 903 ♂ 25-11-33 Wadakkāncheri 400 ft.

Elsewhere noted at: Marāiyūr (Kōdekkadu and Kaipānjimalai ca. 5,000 ft.); Nemmāra (300 ft.).

Colours of bare parts: Iris brown; bill horny black; mouth greyish-pink; legs and feet pinkish-brown ('slaty-grey'—Pillai); claws blackish-brown.

[Measurements:

	Bill.	Wing.	Central tail.	Outer tail.
4 ♂♂	11-12.5	150-151	40-45	122-129 mm.
4 ♀♀	12-13	148-159	41-46	125 mm.

The very distinct juvenile plumage of this swift is well known. The post-juvenal moult apparently does not include the primaries and the coverts, the secondaries and greater coverts, the tertiaries and the tail. Except for these unmoulted parts, the first winter male agrees with the adult male. There is a complete autumn moult in which the body plumage is usually changed well before the wings and tail. There appears to be a partial body moult in the spring.—H. W.]

The Crested Swift is not uncommon in Travancore and Cochin. It is evidently a resident species though in the Nelliampathies, Kinloch (*J.B.N.H.S.*, xxvii, 942) seems to have found it in the cold weather only. It is closely confined to deciduous forest country, and therefore met with especially about the foothills. The birds are partial to *taungya* clearings in this biotope where they may usually be seen hawking insects above the clearing or crops, or perched on the bare topmost branches of trees bordering them. Open, lightly wooded grass jungle also forms a favourite haunt.

It has a variety of loud, rather harsh but not unpleasant notes which are mostly uttered from a perch, but occasionally also on the wing. The commonest of these may be rendered as *whit-uck, whit-uck, whit-uck* etc. while others are best likened to the 'scolding' notes of the Shikra (*Astur badius*).

In the Palni Hills, Fairbank (*S.F.*, v, 393) obtained only a single juvenile at the eastern (dry, deciduous) base, but Terry (*S.F.*, x, 470) records it as pretty common on the slopes and at Pulungi (Pallangi). On 7 April he found a nest in the Pittur (Putthūr) Valley containing one hard-set egg.

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The Crested Swift is resident and generally distributed in Ceylon.

Breeding: The testes of specimen No. 903 (25 November) were enlarged to 5 × 3 mm. and appeared to be maturing. An incubation patch was present although the bird was apparently not breeding as yet. No. 217 (4 February) possessed a fully mature ovary containing a soft egg 13 mm. in diameter. Its oviduct was much distended, however, suggesting that the single egg the bird usually lays had already been deposited. No. 387 (1 March), with testes 5 × 3 mm. and a conspicuous incubation patch, had probably lately finished breeding as it was in post-nuptial body moult. All the August specimens were also undergoing general post-nuptial body moult.

There is no published record of the breeding of the Crested Swift in Travancore or Cochin. The data obtained by the Surveys suggests the season as November-December to February-March, therefore earlier than in most parts of its other Indian range and corresponding rather with Ceylon where it is said (*Fauna*, iv, 355) to lay in February and March.

SUB-ORDER: CAPRIMULGI.

Family: Caprimulgidæ.

Caprimulgus macrourus atripennis Jerdon. Jerdon's Long-tailed Nightjar.

Specimen collected: 76 ♀ 12-1-33 Marāiyūr 3,500 ft.

Elsewhere not satisfactorily differentiated.

Colours of bare parts: Iris brown; bill horny brown, yellowish on commissure and gape; feet pinkish-brown; claws pale horny brown.

[Additional specimen seen:

Trivandrum Mus. Coll.: ♂ 30-8-03 Koni, Travancore.—H. W.]

The specimen was shot at dusk in a roadside field. Several others were observed at the same time squatting at intervals along the High Range motor road in this locality, flying up and into the fallow fields on its edge and back again to the road. The specimen was very fat.

Ferguson (*J.B.N.H.S.*, xv, 662) mentions only 2 specimens of this nightjar from Travancore, both shot on the High Range. He was of the opinion that it did not occur in South Travancore. Kinloch is credited (*Nidification*, iii, 479) with having taken a clutch of 2 eggs in the Nelliampathy Hills in February. This species, however, does not appear in Kinloch's Nelliampathy list (*J.B.N.H.S.*, xxvii, 939-44), and as Mr. Whistler has pointed out (*J.B.N.H.S.*, xxxviii, 35) the record needs confirmation since the parent bird was apparently not collected.

Neither Fairbank nor Terry came across it in the Palni Hills. In Ceylon it is replaced by the typical and darker race *C. m. macrourus*.

Breeding: The gonads of the specimen (12 January) were inactive. There are no published records of its breeding in Travancore, and only the one unconfirmed one from Cochin.

[In *Nidification* (iii, 482) Kinloch is also said to have taken the eggs of *Caprimulgus macrourus albonotatus*, the larger northern race of this nightjar, in the Nelliampathy Hills of Cochin. Confirmation is lacking, but in any case the breeding of both races in the same area seems unlikely.]

Caprimulgus indicus indicus Latham. The Indian Jungle Nightjar.

Specimen collected: 272 ♀ 11-2-33 Thattakād 200 ft.

Elsewhere noted at: Balamore Estate (Ashāmbū Hills, 2,000-3,000 ft.).

Colours of bare parts: Iris brown; fine circumorbital ring yellow; bill horny brown, yellowish on commissure and gape; feet pinkish-brown; claws pale horny brown.

[Additional specimens examined:

Brit. Mus. Coll.: ♂ 29-12-75 Colathoorpolay Valley 1,200 ft. (Hume Coll.); ♀ 2-3-76 Ballochbuir [?] 2,800 ft. (Bourdillon); ♂ no date, ♀ 30-12-79, ♀ 1-11-75, ♀ 29-2-76, ♀ 20-3-76 Mynall 2,000 ft. (Bourdillon); ♀ 23-2-14 Aneichardi Estate (Stewart); ♂ 11-4-83 Pulungi (Terry).

Trivandrum Mus. Coll.: [♀] 29-11-76 Mynall (Bourdillon).

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Measurements:

	Bill.	Wing.	Tail.
3 ♂♂	22-23	174-188	125-128 mm.
9 ♀♀	23-24	181-195	(119.5)124.5-132 mm.—H. W.]

The Jungle Nightjar appears to be somewhat erratic in its distribution. It was common in some of the well-wooded portions of Travancore State and apparently absent from others almost identical. The Survey came across it both in the low country and foothills forest (from ca. 200 ft. elevation) in February, up to at least 3,000 ft. in the Ashāmbū Hills in April. Whether or not it is an altitudinal migrant as suggested by Ferguson (*J.B.N.H.S.*, xv, 662), I am unable to say. F. W. Bourdillon (*S.F.*, iv, 381) even says: 'A winter visitor [to Travancore], occurring rather abundantly from November to March and preferring open grassland at the edge of forest'.

At Thattakād these nightjars were commonly seen flying over and across the Periyār River at dusk, from one bank to the other, performing their aerial contortions and hawking winged insects above the water and above the tall trees near its edge. Numbers of these birds roosted during the day among scrub and fallen teak leaves in a teak plantation along the river bank, whence they issued forth at dusk. In the Ashāmbū Hills, on the fringe of evergreen and mixed forest, it was commonly heard calling at dusk and in the early mornings before sunrise. The call-note, as described by me elsewhere, is *chuck-koo, chuck-koo, chuck-koo,* uttered three to seven times, at the rate of one every second or so and then after a short break, repeated again, and so on for several minutes at a stretch. It was the only nightjar heard in this locality.

The Survey did not hear or come across the Jungle Nightjar in Cochin, where, however it must occur since Kinloch is said to have taken its eggs in the Nelliampathies (*Nidification*, iii, 484).

According to Terry (*S.F.*, x, 470) it is common in the Palni Hills especially at Pulungi and Pittur. In Ceylon it is replaced by the endemic insular race *C. i. kelaarti.*

Breeding: The ovary of the specimen (11 February) was undeveloped and the bird was very fat. According to T. F. Bourdillon (*J.B.N.H.S.*, xv, 663) the breeding season in Travancore is January to March. In the Nelliampathies of Cochin, Kinloch took the eggs in February.

[**Caprimulgus monticolus monticolus** Franklin. Franklin's Nightjar.

Not met with by the Surveys, neither has it been recorded by previous observers in Travancore, Cochin or the Palni Hills.

The inclusion of Travancore in its distribution (*Fauna*, iv, 371) rests apparently on the authority of the single specimen (♀) collected by Surgeon-General Fry labelled 'Travancore', now in the British Museum. As is well known, the data on Fry's specimens is not always reliable, and under the circumstances further evidence is desirable before its occurrence in this area can be admitted.]

Caprimulgus asiaticus asiaticus Latham. The Common Indian Nightjar.

Specimens collected: 605 ♀ juv. 17-4-33, 611 ♀, 612 ♂ 18-4-33 Arāmboli 250 ft.; 956 ♀ 8-12-33 Nemmāra at ca. 400 ft.

Elsewhere noted at: Cape Comorin; Trivandrum; Wadakkāncheri (400 ft.); Trichur.

Colours of bare parts: *Adult*: Iris brown; fine circumorbital rim (eyelids) yellow; bill horny-brown, yellowish on commissure and gape; feet pinkish-brown; claws pale horny-brown. *Juvenile*: Iris brown; eyelids (rim) cream colour; bill pinkish-brown, darker at tip; mouth pink; legs and feet pinkish-brown; claws horny brown.

[Additional specimens seen:

Brit. Mus. Coll.: ♂ 5-6-77 eastern base of Palnis (Fairbank).

Measurements:

	Bill.	Wing.	Tail.
2 ♂♂	17-19	138-145	96-104 mm.'
1 ♀	—	142	103 mm.—H. W.]

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As Ferguson points out (*J.B.N.H.S.*, xv, 662) this little nightjar is very common throughout the low country of Travancore, and to this might also be added Cochin.

Single birds, pairs or loose (family?) parties frequent broken country, fallow and stubble fields, compounds, light scrub or open deciduous jungle at dusk. They squat on the ground or perch on stumps or stones and utter their familiar 'stone-on-ice' calls, *chuck-chuck-chuck-chuck-r-r-* etc. The birds are also invariably seen squatting on motor roads at night—their eyes gleaming red in the beam of the headlights—and flying up just in time to save themselves from the oncoming car, occasionally meeting with disaster. In the early mornings two birds, some distance apart, may frequently be heard answering to each other for long periods.

It apparently does not ascend the Palni Hills either. Fairbank (*S.F.*, v, 393) only obtained a single specimen on the eastern (dry) base of the hills, but saw or heard no other nightjars during five weeks' stay at higher elevations. It is represented in Ceylon by the smaller race *C. a. minor* to which Mysore and Travancore birds approximate in size (*J.B.N.H.S.*, xxxviii, 39).

Breeding: The ovary of No. 956 (8 December) was in a quiescent state. Specimen No. 605 (17 April) was a juvenile with rectrices and wing-quills just sprouting, and it was able to fly short distances with some difficulty. It uttered a quick repeated *chuck-chuck-chuck*, somewhat similar to that of the Painted Sandgrouse, when flushed. Squatting on the ground, it looked exactly like a bit of rotten wood and its colour and pattern blended in a most astonishing manner to render it inconspicuous in its surroundings. From the state of their organs and the fact that they were undergoing body moult post-nuptial, it seemed probable that the two adult April specimens had lately finished breeding.

According to the *Fauna* (iv, 373) this nightjar breeds in Travancore during most months of the year, but most frequently from February to April and then again in July-August.

Lyncornis macrotis bourdilloni Hume. Bourdillon's Great Eared Nightjar.

Specimen collected: 498 ♂ 27-3-33 Tenmalai 500 ft.

Elsewhere not noted.

Colours of bare parts: Iris brown; nostrils and tips of both mandibles blackish-brown; legs pale pink, toes duskier; claws horny brown.

[Additional specimens seen:

Brit. Mus. Coll.: ♂ 4-9-87, ♂ 21-8-87 Konegur (Bourdillon); ♀ (Type) 15-1-75 Kaland, Khauna (Bourdillon).

Measurements:

	Bill.	Wing.	Tail.
3 ♂♂	21-22.5	279-285	182-197 mm.
1 ♀	20	284	186 mm.—H. W.]

Both Bourdillon (*S.F.*, iii, 302) and Stewart (apud Stuart Baker, *Fauna*, iv, 376) seem to have found this large and handsome nightjar fairly common in Central and South Travancore, from sea level up to 2,000 or 3,000 ft. elevation. The type was first obtained by the former (ibid) on 15 January 1875 in a hillmen's clearing on the banks of the Peeuaven-aur, about 15 miles north of Mynall, ca. 600 ft. elevation.

Unfortunately the Travancore Survey came across it only at one camp—Tenmalai—in Central Travancore, and although a special look-out was kept for it all along it was neither seen nor heard thereafter. The birds kept during the day to deciduous forest, emerging into glades and clearings soon after sunset with loud whistling calls of two notes: *whi-wheeeew*. The first syllable in this is short and somewhat abrupt, the second much prolonged. Two or three birds could usually be seen of an evening hawking beetles etc. above the tree-tops and jungle, but the species was by no means common.

In a letter to William Davison (*Ibis* 1888, 146-7) T. F. Bourdillon gives the following account of its habits. He writes from Konegur, where he obtained a specimen: 'It seems to be local but not uncommon where it does occur, for I have seen one or two every night for the last two or three weeks since I have been here. They come out, however, very late; just as the last

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tinge of colour is fading out of the sky one may see one or two of these birds sailing over the fields, seldom flapping their wings, but quartering the ground like a harrier. They do not remain in one place, but travel about a good deal, but seem to return to the same neighbourhood night after night unless one is shot, when they all disappear for four or five days. As a rule they fly slow, at about the same pace as a harrier, except when moving from one place to another, when they go at a great pace, striking the air with vigorous wings.'

This nightjar appears to be confined exclusively to Central and South [?] Travancore. Neither Kinloch nor the Cochin Survey came across it in that State, and it does not occur in Ceylon.

Breeding: The testes of the specimen (27 March) measured 6 × 4 mm. It was very fat, in fresh plumage and presumably preparing to breed shortly. According to the *Fauna* (iv, 376) J. Stewart took a fine series of the eggs of this bird in Travancore between January and the middle of May. He found it breeding generally in bush cover on broken hillsides, but also in deciduous forest in thin undergrowth.

SUB-ORDER: PODARGI.

FAMILY: PODARGIDÆ.

Batrachostomus moniliger Blyth. The Ceylon Frogmouth.

Specimens collected: 220 ♀, 221 ♂ 4-2-33 Thattakād 200 ft.

Elsewhere not noted.

Colours of bare parts: Iris pale khaki or brownish-buff; bill pale horny, yellowish at gape and chin; mouth pale sulphur yellow; gullet pink; feet dusky yellow; claws brownish.

[Measurements:

	Bill.	Wing.	Tail.
1 ♂	23	122	100 mm.
1 ♀	23.5	127	110.5 mm.

Additional specimens seen:

Brit. Mus. Coll.: ♂ 2-3-76, ♀ 19-12-74 Mynall (Bourdillon); [♂♂♀] no date Aneichardi Estate (Stewart); [♂♀] 17-1-15 Venture Estate (Stewart). —H. W.]

The Frogmouth is undoubtedly rare in Travancore and there is no record of it from Cochin. The specimens were put up in dense evergreen scrub and secondary jungle with cane-brakes etc. (see photo, Plate ii with Part I) a few feet off the edge of the now more or less deserted old High Range road. They were quite accidentally come upon, happening to be on the very square yard of ground on which an Iora fell when shot! One of the birds flew up and perched crosswise—like a Passerine bird—on a cane stem a short distance away, screwing its head right round like an owlet to watch the intruder. I did not hear its call and its description appears to be doubtful, but according to the *Fauna* (iv, 382) it has been likened to a soft *kooroo-kooroo* repeated several times.

It has not been recorded in the Palni Hills. The same form is resident in Ceylon.

Breeding: The ovary of the female contained a soft egg measuring 11 mm. in diameter. Its oviduct was very distended, indicating that it had laid. The testes of the male, however, which was evidently the mate of No. 220—as the birds were together—measured only 6 × 4 mm. This discrepancy in the development of the gonads of the birds, if a pair, seems remarkable.

According to Bourdillon (*J.B.N.H.S.*, xv, 663) it breeds in Travancore at elevations of 2,000 to 3,000 ft. from January to the end of February. Stewart, however, has taken eggs from January to May and again in September and October (*Fauna*, iv, 382).

The nest is a pad of moss, leaves, twigs and the bird's down, placed in the fork of small trees 12-16 ft. from the ground, in evergreen jungle, occasionally in deciduous forest, and is conspicuous and without concealment.

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SUB-ORDER: STRIGES.

FAMILY: TYTONIDÆ.

Tyto alba stertens Hartert. The Barn Owl.

Specimens collected: 843 ♂, 12-8-33, 845 ♀ 13-8-33 Beach, Trivandrum, ca. S.L.

Elsewhere not noted.

Colours of bare parts: '♂ Iris crimson and black; bill bluish-white, darker at tips; mouth pink; claws horny black. ♀ Iris bluish-black; bill bluish-white; mouth flesh; claws horny black' (Pillai).

[Only one additional specimen seen:

Brit. Mus. Coll.: ♂ Travancore (Fry).

Measurements:

	Bill.	Wing.	Tail.	Tarsus.
2 ♂♂	34-37	281-288	111-115.5	70 mm.
1 ♀	36.5	278	114	60 mm.—H. W.]

The Barn Owl seems to have been overlooked by the Surveys proper between November and May. Ferguson says (*J.B.N.H.S.*, xv, 667) that it is found occasionally in the low country of Travancore, about human habitations, and to this the two specimens procured by Mr. Pillai in Trivandrum testify. There is nothing on record about its occurrence or status in Cochin, but it is doubtless the same as in this adjoining area.

Mr. Pillai notes that both the birds were shot from an old uninhabited palace by the sea. In the stomach of the female he found the remains of a rat (species?).

In the island of Ceylon the same race is said to occur, but its distribution there seems to be almost limited to the Jaffna Peninsula.

Breeding: The testes of the male measured 19 × 4 mm. The ovary of the female appeared to be maturing, the largest follicles being about 3 mm. in diameter.

According to Ferguson this owl breeds in Travancore during December and January, but the evidence furnished by the specimens suggests that the season is not restricted to those months.

[**Tyto longimembris** (**longimembris** Jerdon). The Grass Owl.

Not recorded from Travancore or Cochin, but Terry (*S.F.*, x, 469) says he flushed an owl in the long grass on a hill-side at Pulungi in the Palni Hills which he thought undoubtedly belonged to this species.]

FAMILY: ASIONIDÆ.

Asio flammeus flammeus (Pontopiddan). The Short-eared Owl.

Specimen collected: 338 ♀ 23-2-33 Peermade, at 4,000 ft.

Elsewhere noted at: Sānthanpāra (3,500 ft.—Cardamom Hills); Karūpadanna (ca. S.L.).

Colours of bare parts: Iris bright lemon yellow; bill slaty-black; mouth livid pink; exposed portion of toes dark brown; soles dirty pale flesh colour; claws horny black.

[Only other specimen from Travancore seen:

Brit. Mus. Coll.: o? 28-12-75 Colathoorpolay Valley, 3,000 ft. (Bourdillon).

The Survey specimen measures:

Bill.	Wing.	Tail.
29	290	139 mm.—H. W.]

Ferguson (*J.B.N.H.S.*, xv, 667) did not come across this owl in Travancore, but mentions that F. W. Bourdillon shot a single specimen at 4,000 ft. elevation at the end of December. Elwes (*Ibis* 1870, 527) also found it in the Cardamom Hills.

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As a winter visitor this owl is probably found in small numbers in our area, but it is on the whole rare. In the Nelliampathy Hills Kinloch (*J.B.N.H.S.*, xxvii, 942) considered it 'very rare indeed'.

The specimen was a solitary bird on an open grass-covered hillside dotted with stunted trees of *Phoenix farinifera* near the Pir's tomb, at about 4,000 ft. elevation. It was very wary and flew about in bright sunlight without apparent discomfort, perching on stones or at the base of tussocks of the coarse *Andropogon* grass. Another single bird was flushed at the same altitude and in identical facies in the Cardamom Hills (25 January), while a third specimen—also solitary—was observed on the grassy laterite plateau adjoining the Travellers' Bungalow at Karūpadanna (ca. S.L.—30 December). No other examples were seen.

It has not been recorded from the Palni Hills by Fairbank or Terry, but Hume (*S.F.*, x, 343) says that it occurs there. It is an irregular winter visitor to Ceylon.

The ovary of the specimen was undeveloped but distinctly granular. The bird was undergoing body moult (pre-nuptial?).

Strix indranee indranee Sykes. The Brown Wood Owl.

Specimen not obtained. Not included in Ferguson's Travancore list. According to the *Fauna* (iv, 400) in Malabar and Travancore this owl seems to be found from the lowest to the highest hills, both in forest and in well-wooded country. Bourdillon is credited with having obtained its eggs in Travancore in January and March.

Strix ocellata (Lesson). The Mottled Wood Owl.

Specimen collected: 1032 ♂ 28-12-33 Karūpadanna ca. S.L.

Elsewhere noted at: Arāmboli (250 ft.); Nemmāra (300 ft.); Trichūr.

Colours of bare parts: Iris dark brown; eye-lids dusky pink; bill and claws horny black; toes brownish-flesh.

[The specimen measures:

Bill.	Wing.	Tail.
41.5	333	178 mm.

This species has no races. I cannot detect any difference between the Survey bird and the only Travancore specimen in the British Museum (viz. Fry Collection—no data. The moults have not yet been worked out for lack of specimens).—H. W.]

The Mottled Wood Owl seems to be confined to the low country in Travancore and Cochin, where it is probably not uncommon. Ferguson's collectors shot two specimens on an island in the Vembanād Backwaters in January 1903, and he describes the species as fairly common from Arukutty to Vycome (*J.B.N.H.S.*, xv, 667).

The specimen was one of a pair in an ancient tree in a cocoanut plantation around a backwater homestead. Its stomach contained remains of a field mouse and a large scorpion with sting intact! Ferguson's specimens had eaten crabs and beetles.

Its quavering, somewhat eerie call *chūhūū-ū* was chiefly heard at dusk and in the early mornings, just before the birds emerged from their daytime retreats, or retired to them. The call uttered throughout the night is usually a metallic hoot, not unpleasant to the ear.

The southern range of this owl as limited in the *Fauna* (iv, 403) to 'the Carnatic and to the base of the Nilgiris' must be extended to include the entire southern extremity of the Peninsula. The species has not occurred in Ceylon.

Breeding: The testes of the specimen had enlarged to 10 × 5 mm. (grey pigmented), and it was apparently preparing to breed. Ferguson's statement that the eggs of this owl were brought to Bourdillon by the hillmen in June cannot be accepted as authentic in the absence of more reliable data.

(To be continued).

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THE FOXES OF BRITISH INDIA.

BY

R. I. POCOCK, F.R.S.

(*From the Zoological Department of the British Museum, Natural History*).

(*With three text-figures*).

In his volume on the *Mammals of British India* Blanford admitted five species of Foxes under the following names:—the Indian Fox (*Vulpes bengalensis*), the Hoary Fox (*V. cana*), the Indian Desert Fox (*V. leucopus*), the Common Fox (*V. alopex*) and the Small Tibetan Fox (*V. ferrilatus*). It cannot be claimed that the popular names were all well chosen. *V. bengalensis*, it is true, may be regarded as the Indian Fox *par excellence* because it is restricted to Hindostan, whereas the others are aliens from the north and north-west and never penetrated far into the country. Moreover *V. bengalensis* lives alongside *V. leucopus* in Rajputana and Sind and in those districts is as deserving of the name 'Indian Desert Fox' as the latter. The name 'Common' was applied to the large Himalayan Fox because Blanford, quite correctly in a sense, thought it was the same as the ordinary European Fox. It is in reality a local race of it and 'Hill Fox' would be a much better term so far as India is concerned. 'Small Tibetan Fox' is also misleading because the species is about as large as the Hill Fox which also occurs in Tibet. It may more appropriately be called the 'Tibetan Desert Fox' because its colouration suggests that environment. As for the 'Hoary Fox' since that epithet is not half so appropriate for this pigmy Afghan fox as for the larger species of that country, I propose to name it 'Blanford's Fox'.

Only two of the scientific names used by Blanford have to be altered. His *V. alopex* becomes *V. vulpes montana*, which expresses the view that the animal is a local race of *V. vulpes* which ranges from Europe through Central and Northern Asia into North America; and his *V. leucopus* becomes *V. vulpes pusilla* because this fox also is nothing but a local race of *V. vulpes*, not a distinct species in the sense that *bengalensis*, *cana* and *ferrilata* are distinct; and also because the name *pusilla* was printed before *leucopus* and therefore has the claim to admission. Thus Blanford's five species are reduced to four; but one of them, namely *V. vulpes*, is represented by three definable local races.

In this, as in other papers of mine, on the *Mammals of British India* published by the Bombay Natural History Society I have made as much use as space permits of the very valuable and instructive details regarding dates, measurements and so forth contained on the labels of the splendid collection of skins procured

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by the 'Mammal Survey' of British India organised by the Society. Similarly detailed dimensions of a considerable number of the skulls are given to show their variations. It may be thought that the tables of measurements are unnecessarily long; but nothing is more irritating and unsatisfactory in systematic descriptions than such general statements as that one species, or race, differs from another by having a larger or smaller skull or teeth, without the addition of actual measurements to show the points. Tables also have the advantage of showing at a glance the very considerable individual variation of foxes from the same locality and obviously belonging to the same race. Similar variations in the skulls and teeth in foxes from different localities have been used for the establishment of distinct species and races.

Genus: VULPES, Oken.

Vulpes Oken, *Lehrb. Naturg.* iii, pt. II, pp. 1033-4 (1816); Miller, *Cat. Mamm. Centr. Europe*, p. 325 (1912).

Type of the genus: *Canis vulpes* Linn.

Distribution: The greater part of the old world, except Madagascar, S.-E. Asia and Australasia, and of N. America as far south as Mexico.

Distinguished from *Canis* and *Cuon*, the other genera of *Canidae* inhabiting British India by having the forehead of the skull between the postorbital processes flat, not inflated by air-cells, the processes themselves slightly concave, with raised anterior edge, instead of convexly rounded, and the canine teeth typically longer, the upper with their points reaching as low as the inferior margin of the mandible, and the points of the lower reaching well above the line of insertion of the upper incisors.

Key to the Species based on external characters.

A. Tail and ear long, tail over half the length of the head and body, ear much more than half the length of the hind foot.
   1. Tip of the tail white; upper half of back of ear black and strongly contrasted with tint of head and nape (four pairs of mammae) ... ... *vulpes.*
   2. Tip of the tail black; backs of the ears generally nearly the same tint as the head and nape, never jet black and strongly contrasted.
      a. Larger; coat never very long and full; colour brownish or ochreous on the back, the contour hairs always with pale band giving a speckled look to the pelage (three pairs of mammae) ... *bengalensis.*
      b. Smaller; coat very long, full and loose; the contour hairs extensively white and black so that the pelage is never closely speckled ... ... *cana.*

B. Tail and ear short, tail less than half the length of the head and body; ear less than half the length of the hind foot ... ... *ferrilata.*

Key to the Species based on the skull and teeth.

A. Muzzle comparatively short and broad, its width above pm^2 about one-third the length of the palate; canines moderately long, height of upper from base to point less than combined lengths of upper carnassial (pm^4) and first molar (m^1) as set in jaw.
   1. Nasals on the average narrower posteriorly; the upper carnassial relatively larger as compared with the first molar.
      a. Skull in smallest ♀ over 100 mm. in condylo-basal length ... ... *vulpes.*
      b. Skull in adult ♂ up to about 90 mm. ... *cana.*

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2. Nasals on the average broader posteriorly and upper carnassial smaller as compared with first upper molar ... ... *bengalensis.*

B. Muzzle long with concave lateral margins, its width above pm^2 about one-quarter the length of the palate; canines very long, height of upper exceeding combined lengths of pm^4 and m^1 ... ... *ferrilata.*

Vulpes vulpes, Linn.

Canis vulpes Linn., *Syst. Nat.*, ed. 10, vol. i, p. 40 (1758). [For descriptions and full synonymy of typical *Vulpes vulpes* from Sweden and of related European forms, see Miller, *Cat. Mamm. Western Europe*, pp. 330-40 (1912).]

Locality of the type: Sweden.

Distribution: Europe from the Arctic coast to the Mediterranean and Africa north of the Sahara; Asia from the far north to S. Arabia, N.-W. India, the Himalayas, S. China and Tonquin and the greater part of N. America from the Arctic coast southwards to California. Absent from the greater part of Peninsular India, Ceylon, Burma, Malaya, Siam, Sumatra, Java and Borneo. The range agrees on the whole very closely with that of the Wolf (*Canis lupus*) and of the Bear (*Ursus arctos*), but is more extensive at all events to the south.

Distinguished by the combination of black backs to the ears and a white tip to the tail; although commonly called the 'red-fox', on account of the dominance of that tint, the colour is very variable both individually and locally, the contour hairs of the back being sometimes flavescent, 'silvery' or black to a varying extent. The size is also variable. Although typically considerably exceeding on the average that of other species, some of the sub-species are comparatively small. Usually at all events there are four pairs of mammae in the ♀.

Vulpes vulpes montana, Pearson.

The Hill Fox.

'The Hill Fox' Royle, *Journ., As. Soc. Beng.*, vol. i, p. 99 (1832).
Canis vulpes montana Pearson, *Journ., As. Soc. Beng.*, vol. v, p. 313 (January 1836).
Canis himalaicus Ogilby, *Proc. Zool. Soc.*, p. 103 (October 1836); and in Royle's *Botany of the Himalayas, Mamm.*, p. lxvi (1839).
Vulpes nepalensis Gray, *Charlesw. Mag. Nat. Hist.*, vol. i, p. 573 (1837).
Vulpes alopex Blanford, *Mamm. Brit. India*, p. 153 (1881).
Vulpes vulpes waddelli Bonhote, *Proc. Zool. Soc.*, p. 303 (1906).
Vulpes ladacensis Matschie, *Filchner's Exped. Chin.*, p. 167 (1907).

Locality of the type of *montana*, 'Himalayas'; of *himalaicus*, Mussoorie; of *nepalensis*, Nepal; of *waddelli*, Kambajong, Tibet; of *ladacensis*, Ladakh.

Distribution: Himalayas from Gilgit eastward to Sikhim; Tibet and Yunnan.

Distinguished from the typical Scandinavian race and the other races of Continental Europe admitted by Miller by its smaller size on the average, especially indicated by the skull and teeth (see p. 42).

Notes on the synonymy: The type of *montana*,[1] of which the exact locality is unknown, was described as having a dark rufous cross on the back set off by light fawn on the neck and behind the shoulders; the sides of the body and the shoulders being grizzled and the underside dark. Blyth, who had Pearson's type and stated that the fox occurs at Simla and Mussoorie, described it as much less rufous than the European fox and paler and more hoary [*Journ., As. Soc. Beng.*, vol. xxiii, p. 730 (1854)]. He also astutely suggested that it might prove to be the same as the large fox of Afghanistan

[1] Wrongly stated by Mivart [*Mon. Canidae*, p. 96 (1890)] to be in the British Museum.

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described by Griffith. From the description it appears that this fox comes between the 'red' and the 'hoary' types since it agrees tolerably closely with skins from Kangra, Chamba and Simla referred to below.

The type of *himalaicus*, from Mussoorie, was described as bright bay on the back, yellowish on the sides of the body, white on the side of the neck, hoary grey on the hips and smoky brown below. Ogilby's type, which is in the British Museum, is now tawny red above, with hardly a trace of black, but with some buffy white on the loins, isabelline on the flanks, silvered and hoary on the thighs, sooty below, set off by bright buff on the chest. Although both Ogilby and Blyth considered *himalaicus* to be a synonym of *montanus*, the two types do not agree in colouration, *himalaicus* belonging to the first category mentioned below.

The type of *nepalensis*, one of Hardwicke's Nepalese specimens of which the whereabouts is unknown, was described as bright fulvous yellow above, like the English fox but with the fur brighter and much softer. According to Blyth [*Journ., As. Soc. Beng.*, vol. xxiii, p. 730 (1854)] this is a large fox with very fine, long, dense fur, bright light yellowish fulvous in colour and with a huge brush. According to him it occurs in Tibet, rarely south of the snows. Possibly Hardwicke's specimen was a traded skin; but the description agrees very closely not only with some Tibetan skins in the British Museum but with one from Sikhim and some from Kumaon as stated below.

The type of *waddelli*, from Kambajong, Tibet, 16,400 ft., was regarded by Bonhote as distinct from *montana* because it represented a redder type than any of the Himalayan skins in the British Museum at that time. It is not redder, however, than skins from Sikhim, Kumaon and elsewhere subsequently received.

The name *ladacensis* was given by Matschie to a skin from Ladakh which he thought was specifically identical with the paler of the two foxes collected by Stolicka in Turkestan and illustrated by Blanford (Fig. 1, Pl. II) in the report on the Second Yarkand Mission, 1891. Matschie was apparently quite unaware of the individual variation in the colour of foxes. There is no doubt that the two foxes depicted on the plate by Blanford merely represented colour phases of one and the same subspecies, comparable with 'red' and 'flavescent' phases of *montana* from Kumaon, Sikhim and Tibet, although Matschie regarded them as specifically distinct. I have seen no foxes from Ladakh, but one from Gilgit, in the same river valley, is inseparable from *montana*.

The British Museum has the following Himalayan skins:—

Sikhim, Kapup, 13,000 ft., Ad. ♂ (Crump coll.), November 24th, in fresh winter coat is bright reddish bay from nape to loins with scarcely any black or buff or grey areas in the contour hairs, but the forehead and cheeks have a good deal of whitish; the thighs are hoary grey, the underside white, the top of the tail red, and the fore legs darkish tawny, with a grizzled black streak to wrist; hind legs paler.

Sikhim, Thanga, in the Upper Chambi Valley, 11,000 ft., Ad. ♀ (Crump coll.), January 4th, in mid-winter coat, is much paler and yellower, the contour hairs bleached to buff on the back, the bright tint being restricted to the back, with the flanks greyish; the fore legs also are much paler; the underside is white.

Tibet, Kambajong, 16,400 ft., Ad. ♂, Oct. 8th (type of *waddelli*), is very like the Kapup skin, but has the contour hairs on the flanks paler. A second skin named *waddelli* by Bonhote, from Pharijong, January 11th, is like the Upper Chambi skin, but rather brighter. Two undated skins labelled Tibet (Hodgson) are also a little brighter and more golden than the Chambi skin, the three being intermediate between the two skins assigned to *waddelli*. An adult ♂ from Dachin, Tibet, 14,700 ft. (Col. Bailey), June 22nd, is in full moult, all the contour hairs of the back being shed, leaving a thick coating of tufted dark, chocolate wool. Another ad. ♂ from Gyantse, 13,000 ft. also from Col. Bailey, undated, is in much the same condition but a few contour hairs, with the tips bleached white, dead and shrivelled, remain.

All these skins are white-bellied. The redder of them belong to the phase represented by the type of *himalaicus* and the paler agree precisely with Gray's description of *nepalensis*.

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No fox of this type has been recorded from Bhotan, Assam or Upper Burma; but it occurs in Yunnan, whence the Museum has two skins, both from Tengyueh, an adult ♀, 9,000 ft. (Howell), February 11th, which is an almost exact match of the skin from Kapup in Sikhim; and an ad. ♂, 6,000-7,000 ft. (Forrest), dated December 24th, but almost certainly wrongly, because the whole of the back behind the shoulders is covered with brown wool with a few white-bleached contours, as in Col. Bailey's Tibetan skins; but the nape and shoulders still retain the long fluffy contours, resembling in colour the paler skins of the *nepalensis* type from Tibet and Sikhim.

Kumaon: A series of six skins (Crump) closely resembles those described above. The extremes in colour are an ad. ♂ from Lohaghat in Almora, 5,600 ft., February 6th, which is dark reddish bay above from the head to the tail-root as in the skin from Kapup, Sikhim, but there are some black tipped hairs on the nape and shoulders and the belly is mostly blackish; and an ad. ♀ from Champawat in Almora, 5,850 ft., February 21st, which is much paler, with the general colour above buffy yellow, the fur of the back grey-brown, instead of sooty and the throat and chin and greater part of the belly white, with some dark grey on the chest. A second from Lohaghat closely matches the Champawat ♀. Two ad. ♂ skins from Takula, 5,350 ft., October 12th and 15th, are like the first described ♂ from Lohaghat, whereas a ♀ from Takula, October 12th, is paler, intermediate between the ♂ Takula skins and the pale ♀ from Champawat.

These skins also exhibit the colour phases represented by the types of *himalaicus* and *nepalensis* respectively.

Mussoorie: In addition to the type of *himalaicus* above described the Museum has another skin 5,500 ft. (Hutton) which is very like it, but has more white banding in the contour hairs of the hind quarters, and is white below in the middle line instead of slate grey.

Simla: A series of four skins (Hume) shows great individual variation. Two, ♂, ♀, closely resemble the Mussoorie skins, another ♀, September 28th, is much darker, all the hairs of the dorsal surface being black-tipped and buff below the tip, the general effect being grizzled brown from the crown backwards. Another ♀, September 26th, is still darker than the last, the pale areas of the contour hairs being much less evident, especially on the nape and shoulders, which are heavily blackened; the underside is sooty and the legs are very dark. The general effect is a blackish fox, speckled with buff or grey, with a brighter buffy cross-mark down the spine and across the shoulders. Another ♀ skin (Blanford), October, is short coated and marked above with a dark rusty red cross showing no buff or black speckling; the thighs and fore legs are blackish speckled with white. This skin of Blanford's agrees very closely with the type of *montana* as described by Pearson, but neither appears to be in complete coat, judging from the distinctness of the 'dark rufous' cross mark on the back; and it is evident from Blyth's description of the foxes from Simla and Mussoorie that the skins he saw and described as much less rufous, paler and more hoary than European foxes, belonged to the type prevalent at Kangra and Chamba.

Kangra Valley: Four skins (Wells coll.) in good coat are of the 'crossed or decussate', hoary type with the bright colouring reduced on the back and the contour hairs marked with a broad whitish band and a black tip, the black often dominant. Ad. ♂ from Gopalpur, 6,000 ft., February 29th, is dark reddish tan down the back with abundance of black but not much of the pale tint; flanks grey; thighs and shoulders hoary; underside smoke-grey; fore legs dark hoary, with dark tan paws; hind dark tan with dark hoary patch. A second ad. ♂ from the same locality, 5,600 ft., February 18th, is a good deal paler above than the last, but has more black on the limbs. Ad. ♀ from Sanyala, 4,500 ft. May 8th, is still paler, yellowish down the back, with the dark hair-tips scarcely evident, but the thighs and sides of the shoulders hoary, the throat sooty and the abdomen covered with short red hairs in preparation for suckling. An undated skin from Baijnath is very dark with a dull ochreous tint in the dorsal contour hairs and the fur nearly black.

Chamba: A series of nine skins collected by Wells in December and January between 4,000 and 5,000 ft. Two only, one from Pukri, 4,000 ft., and another from Bara Tissa, 7,500 ft., are of the reddish type like the richer skins from Kumaon. The rest from Pukri, Bara Tissa, Chalan Tissa,

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6,700 ft., Chatri, 5,000 ft., and Siluni, 5,000 ft., are darker with the bright colour on the back not so red, but varying from ochreous to reddish brown and more restricted, forming a broad band or cross, more or less obscured by the black tips of the hairs; the thighs, flanks and sides of the shoulders hoary. These are like the dark Kangra skins.

Gilgit: Two skins of the red and paler phases, like those of Tibet, Sikhim and Kumaon. One 5,000 ft. (Biddulph), October 7th, in fresh winter coat has the contour hairs of the back tolerably uniformly red without appreciable pale areas or black tips; the underside has the throat ashy, the abdomen ashy overcast with white and the inguinal region white; the legs have some black and white hairs on their front surfaces. The second, 6,000 ft. (Major W. F. R. Trevelyan), is in full moult, most of the contour hairs being shed, leaving the woolly coat exposed. The coloured area of the back is reduced in extent and not so red as in Biddulph's skin, the general tint being faded to bright ochreous, with the head still paler; the rest of the upper side is covered with thick tufted wool, white on the sides of the neck and flanks, pale sooty on the hind back; the under side is ashy; the legs are more heavily pigmented in front than in Biddulph's skin and the tail is mostly covered with white wool.

From the evidence of the skins, mainly collected by the Mammal Survey, it seems that the Hill Fox undergoes remarkable change in colour when traced westwards through the Himalayas from Tibet and Sikhim. The eastern form varies from bright reddish bay to bright yellowish fulvous, with scarcely a trace of black and very little silvery white in the pelage. The reddish phase was named *himalaica* and the fulvous or flavescent *nepalensis*. These are the only phases hitherto recorded from Sikhim and Kumaon. But the red phase also occurs in Mussoorie, Chamba and Kangra. In these districts, however, the 'hoary' phase, described as *montana*, and distinguished by the reduction of the bright hue of the back and by the generally black and white colouration of the contour hairs of the flanks and elsewhere, is prevalent. These may prove to represent distinct races, *himalaica* and *montana*, but for the present I prefer to regard them as one, since in N. America the 'red', the 'hoary' and the 'black' or silver-tip phases occur in the same locality. But I have given racial status to a still more hoary form found to the west of Chamba and Kangra and typified by a fox originally recorded from Kandahar and named *griffithii*.

The following are the flesh-measurements converted from millimetres into English inches and some weights of the largest and smallest males and females of *montana* from each district:—

...		Head and Body	Tail	Hind foot	Weight
Sikhim, Kapup	... ad♂	27⅕	17⅘	6⅜	...
,, Thanga	... ad♀	24⅜	15⅔	6	8¾ lbs.
Kumaon, Almora	... ad♂	25	16⅘	6	10¼ ,,
,, Takula	... ad♂	22⅘	17⅕	(4-)	10½ ,,
,, ,,	... ad♀	23½	15⅘	5⅜	8½ ,,
,, Almora	... ad♀	22⅔	14	5⅔	8 ,,
Kangra, Gopalpur	... ad♂	28	18	6	...
,, ,,	... ad♂	26⅘	17⅘	5⅘	11¼ lbs.
,, Samyala	... ad♀	24⅘	13⅔	5⅔	8 ,,
Chamba, Pukri	... ad♂	29⅜	18	6	...
,, Bara Tissa	... ad♂	26	14⅘	5⅔	...
,, Chalan Tissa	... ad♀	26	13⅜	5	...
,, ,, ,,	ad♀	25⅕	16⅕	5⅘	8 lbs.

The ear is usually about 3½ in. long, measured from the notch, but may be 4 in. (100 mm.).

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The table suggests that the foxes from Kangra and Chamba are bigger, sex for sex, than those from Kumaon, but since this is not borne out by the skulls the apparent difference is probably due to the 'personal equation' of the collectors, Wells and Crump, respectively.

Of the measured Tibetan skins Col. Bailey's ad. ♂ from Dachin and the type of *waddelli* from Kambajong have a head and body measurement of 26¾ in. and 25 in. respectively; and the ♂ and ♀ skins from the Tengyueh Valley in Yunnan are exactly the same in head and body as the ♂ and ♀ from Sikhim. The tails and hind feet of these Tibetan and Yunnan skins similarly agree very closely with those of the Sikhim and Kumaon skins.

From the available data it does not appear that the flesh-measurements of this fox are appreciably less than those of the Continental European foxes, although the skulls as recorded below are decidedly smaller.

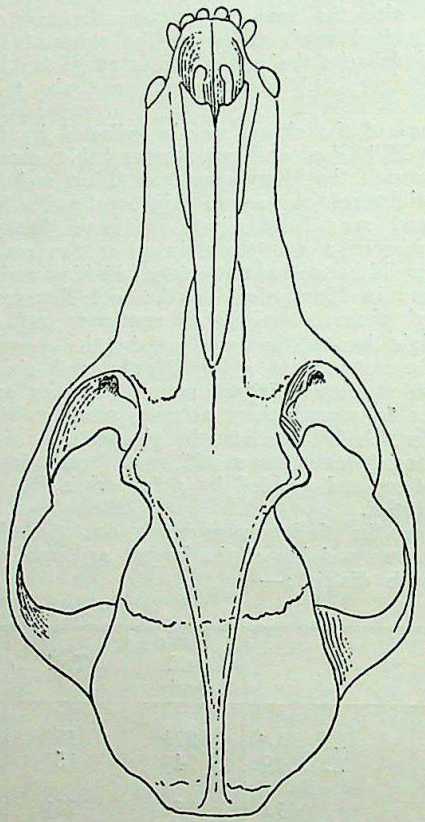

Fig 1.—Skull of ad. ♂ of *Vulpes vulpes montana* from Takula, Kumaon, ×⅓

Skulls of *montana*, sex for sex, are smaller on the average than those of the three British and Continental European races of *V. vulpes*, admitted by Miller, namely *V. v. vulpes* from Scandinavia, *V. v. crucigera* from Central Europe and Italy and *V. v. silacea* from Spain which are closely related. In ♂ skulls of *montana* the condylobasal length varies from 128 to 141 mm. with an average of about 136 mm., the same measurement for ♀ skulls being from 123 to 132 mm. and the average about 130 mm. In the European races ♂ skulls range from 136 to 155 mm., with an average of about 145 mm., and ♀ skulls from 126 to 141 mm. with an average of about 134 mm. The teeth also of *montana* appear to be similarly a little smaller, especially the upper carnassial (pm^4).

In the table of skull measurements of this race (p. 45) the zygomatic and the postorbital, or 'waist', widths are entered because it is customary to

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record them. They are, however, of very little use because they vary with age after the skull has attained its full length, the zygomata becoming wider and the postorbital area narrower from muscular moulding as the skull gets older.[1]

The two skulls from Simla, which have no skins, were collected by B. B. Osmaston. It may be added that the two unsexed skulls of Bailey's Tibetan specimens, above referred to, have a condylobasal length of 134 and 139 mm. respectively, that the adult ♂ skull of the type of *waddelli* is 136 mm. and the ad. ♂ and ♀ skull from the Tengyueh Valley in Western Yunnan are respectively 139 and 130 mm. with a mandibular length of 110 and 104 mm. All these skulls fit in with the Himalayan series of *montana*. Finally the skull belonging to the skin collected by Biddulph at Gilgit, although immature and defective, has the upper carnassial (pm^4) and the upper molar (m^1) the same size as in *montana*.

Vulpes vulpes griffithii, Blyth.

Vulpes flavescens Hutton, *Journ., As. Soc. Beng.*, vol. xiv, p. 344 (1845), (with descriptive note by Blyth); Blyth, *Journ., As. Soc. Beng.*, vol. xxii, p. 581 (1853), (not *flavescens* Gray).

Vulpes griffithii Blyth, *Journ., As. Soc. Beng.*, vol. xxiii, p. 730 (1854); Scully, *Ann. Mag. Nat. Hist.* (5), vol. viii, p. 226 (1881).

Locality of the type: Kandahar in Afghanistan.

Distribution: Southern Afghanistan, Waziristan and Murree.

A trifle smaller on the average, judging from the few available skins, than *montana*, and, although exhibiting the red phase, typically extensively hoary and silvered with the brighter tint reduced to a wash of pale ochreous forming a narrow band down the back, considerably paler and less extensive than in the Chamba skins of *montana*, but intergrading with the latter and also with the next race *pusilla* both in the Punjab and Baluchistan.

Hutton, who was the first to give an account of this fox, said:—'The fox of Afghanistan, or at least of the southern and western parts, is apparently the same as our Himalayan species, though somewhat less in size. . . It is common in the valleys round Kandahar hiding in burrows and holes, in rocks'. He gives, however, measurements of two ♀ specimens which show equality in size to ♀ *montana*. In a note to Hutton's account, Blyth, to whom Hutton sent the type, quoted Griffith's statement that 'a large and small species of fox appear to exist in Afghanistan. The former perhaps is the same as the Large Himalayan Fox found at Quetta and Olipore. The small seems to resemble the fox of the plains of India.' Blyth, quite wrongly, I think, identified Hutton's specimen, for which he adopted the name *flavescens*, as the Small Afghan Fox described by Griffith;[2] but he described it as having 'the longer hairs black-tipped, yellowish white along the back, white on the sides, the face fulvous with a blackish patch on the muzzle, the fore leg blackish in front, the hind paw with a blackish spot above and the under side dusky.' In the following year he named this fox *griffithii*. Later Scully repeated the information supplied by Hutton[3] and Blyth about the fox and gave some measurements of a skull from Kandahar which he referred to *montana*.

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[1] Here and elsewhere in this paper the maxillary width is the width of the muzzle above the root of the canines; the upper cheek teeth are measured from the crown of the last tooth (m^2) to that of the canine; the mandible from the condyle to the sockets of the incisors; the upper carnassial (pm^4) and the first molar (m^1) along their outer margins and the lower carnassial (m_1) along its middle line.

[2] This was no doubt the species subsequently named *Vulpes cana* by Blanford (see below, p. 53).

[3] The length of the tail given by Hutton as 17 in. was misquoted, or misprinted, by Scully as 27 in.

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Blanford, misled by Blyth's identification of Hutton's Small Kandahar Fox as *griffithii*, wrongly identified the latter as *leucopus* (=*pusilla*).

The British Museum has the following skins:—

Wano in Wazaristan near the Afghan-Baluchi border. A young ad. ♂ (W. B. Cotton), December 19th, has a faint ochreous wash from the nape forming a narrow band down the back but scarcely traceable on the loins; the head and face are tan with a conspicuous black patch on the muzzle; the fore legs are tan with some grey down the front and a pale grey patch on the paws; the hind legs cream-buff with no black and the whole of the under side is sooty. This specimen agrees very closely with Blyth's description of the type of *griffithii*.

Gharial in the Upper Punjab, near Murree. 7,000 ft. An ad. ♀ (Major Dunn), July 27th, differs from the last in having a lighter muzzle patch, the hairs of the crown more bleached and worn and the ochreous wash only traceable behind the shoulders but stronger on the loins than in the Wazaristan skin; the black is more dominant on the nape and shoulders which are blacker than the hoary flanks; the fore legs are deep tan with a conspicuous blackish grey streak down the front; the hind whitish below the hocks in front with some infuscation and the abdomen, covered with short new hair, is white, the chin also is white but some old hair adhering to the throat and the chest is smoky grey.

Kotli in the Murree Hills, 5,800 ft. (Wells). An ad. ♂, June 19th, is changing coat, with some long contour hairs, retained on the back, dark tipped, with white, or on the back buffy, subterminal band; but wherever the new coat is exposed above, i.e. on the head, thighs, back etc., it is ochreous whereas on the chest and belly it is white; the legs are as in the Gharial skin, but there is practically no bright colour on the tail above except at the base. The appearance of this skin suggests that, with the moult completed, it would be indistinguishable from the skins in summer coat of the two examples of the next race, *pusilla*, collected at Ava in the Salt Range by Col. Stockley.

Murree, 7,000 ft. (Dr. J. E. T. Aitcheson). An ad. ♂ resembles the Sikhim and Kumaon and a few of the Chamba skins in exhibiting the red phase of colouration.

The only available flesh measurements, in English inches, are the following:—

		Head and Body	Tail	Hind foot
Murree Hills, Kotli	yg. ad. ♂	23⅜	17⅛	5⅜
Gharial near Murree	ad. ♀	23	15	5⅛
Kandahar (Hutton)	ad. ♀	24	17	...

These data are too scanty to establish definite conclusions. They merely suggest that *grifithii* is on the average smaller than *montana*, sex for sex.

The first skull of *griffithii* in the table was collected by Swinhoe and is marked 'Scully', indicating that it is the one above referred to of which Scully published some measurements, namely the condylobasal length, the zygomatic width, the length of the mandible and the three teeth. My measurements agree very closely with his, except in the condylobasal length, which he entered as 139 mm. This was no doubt a misprint. At all events a skull of that length would have had a mandible exceeding 100 mm. The second Kandahar skull was presented by Blanford. The third was another of Swinhoe's. Their dimensions are inserted to show their general agreement with the skulls from the Murree Hills and Wazaristan. The second ad. ♂ skull from the Murree Hills belongs to the skin in the red phase collected by Aitcheson. It is smaller than the smallest of the ♂ skulls of *montana*.

An interesting point is the exceptional size of the teeth in the first skull. They are equal to the teeth of a considerably larger race of fox found in Western Turkestan, the Altai and near Lake Baikal, which I identify as *beringiana*, and are larger than in *montana*, although the teeth of the remaining six skulls of *griffithii* are on the average smaller than in *montana*.

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CRANIAL AND DENTAL MEASUREMENTS OF THE LARGEST AND SMALLEST ♂ AND ♀ SKULLS OF *V. V. MONTANA* AND *GRIFFITHII* ARRANGED ACCORDING TO LOCALITY.

LOCALITY AND SEX	Cond. Bas. Length	Zygom. Width	Postorb. Width	Int. Orb. Width.	Max. Width	Upper Cheek Teeth	Mand. Length	pm^4	m^1	m_1
montana										
Sikhim, Kapup yg. ad. ♂	139	72	23	26	24	65	110	13	9½	15
,, Thana old ♀	131	73	23	27	22	62	102+	12	9	14+
Kumaon, Takula ad. ♂	141	76	21	27	22¼	66	108	13	8¼	15
,, ,, ad. ♂	129	74	21	27	22	60	100	12	9	13½
,, ,, ad. ♀	132	72	21	25	20	62	103	12	9	14
,, Almora ad. ♀	129	69	20	25	21	61	100	12	9	14
Simla, Dagshai ad. ♂	135	75	22½	26	23	64	104	12	10	16–
,, Chakrata ad. ♀	132	74	23	26	23	61	100	12¼	9½	14
Kangra old ♂	140	78	20	27	24	65	110	13	9	14
,, ad. ♂	134	75	23	28½	24	64	103	12	9	13
,, oldish. ♀	127	71	19	24	20	60	98	12	10	14
Chamba, Pukri ad. ♂	137	77	20	29	24	64	108	13–	10–	15
,, Bara Tissa ad. ♂	128	71	23	26	20	60	96	12	9	14
,, Chalan Tissa ad. ♀	130	74	20	27	22	60	101	12	9½	14½
,, Charan Tissa ad. ♀	123	69	24	23	19	56	93	12	9½	14
griffithii										
Kandahar ad. ? ♂	132	69	22	23	21½	62	100	14	10½	16
,, ad. ? ♂	127	65	17	23	19	59	94	12	9	14
,, ad. ? ♀	124	65	18	22	19–	57	94	12+	8	14
Wazaristan, Wano yg. ad. ♂	127	67	23	24	21	58	96	12	9½	14
Murree Hills, Kotli ad. ♂	127	72	22	26	21	59	99	12	9	14
,, ,, ad. ♂	125	72	22	25	21	60	90	12	9–	14
,, ,, Gharial ad. ♀	125	72	20½	26	21	58	99	11	8¼	13

Vulpes vulpes pusilla, Blyth.

Vulpes flavescens, Blyth, *Journ., As. Soc. Beng.,* vol. xxii, p. 581 (1853); Gray, *Proc. Zool. Soc.* p. 517 (1868), (not *flavescens* Gray, 1843).[1]

Vulpes pusillus, Blyth, *Journ., As. Soc. Beng.,* vol. xxiii, p. 729 (1854).

Vulpes leucopus, Blyth, *Journ., As. Soc. Beng.,* vol. xxiii, p. 729 (1854); and vol. xxv, p. 443 (1856); Blanford, *Mamm. Brit. Ind.*, p. 151 (1888), and of subsequent authors.

Vulpes persica, Blanford, *Ann. Mag. Nat. Hist.* (4), vol. xvi, p. 310 (1875); *Zool. of Eastern Persia,* p. 39, pl. 2 (1876).

Locality of the type of *pusilla,* the Salt Range; of *leucopus*, Moultan; of *persica,* Shiraz.

[1] *Vulpes vulpes flavescens,* a name which figures in the bibliography of Indian foxes, is a fox from N. Persia as large as *montana* and related to it. It occurs in two colour phases, the typical 'flavescent' and the 'red'. The latter was named *splendens* by Thomas. That at least is my interpretation of *splendens*.

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Distribution: Throughout the more or less desert districts of N.-W. India from Rawalpindi to Rajputana, Sind and Cutch and through Southern Baluchistan to Southern Persia and Mesopotamia.

Size very variable but considerably smaller, sex for sex, than *montana* and a little smaller than *griffithii;* general colouration very uniform, apart from seasonal changes, throughout the vast range of the race, never exhibiting the 'red' phase in the winter coat, not very different from some skins of the 'flavescent' type of *montana*, but much less black than the dark Kangra and Chamba skins of that race and never so silvered and hoary as in typical *griffithii* and with the ochreous or buffy hue of the dorsal side much more extensive. The seasonal changes in colour are very marked as described below in the case of the Salt Range skins; but, in addition, when the coloured contour hairs are first shed the tint of the back may be dark greyish brown.

In his first reference to this fox as *flavescens* from the Salt Range, Blyth described it as 'much brighter than Afghan skins, tints purer more contrasted, legs paler, redder, less black than *montana*'. A year later, when he named it *pusillus*, he said that it nearly resembles *montana* but is smaller. The name *pusillus* has line priority over *leucopus* and, according to the rules of nomenclature, should be preferred.

In his description of *leucopus* Blyth quoted Elphinstone's observation that the fox of the Western Hurriana desert is smaller than our fox (*montana*) and in one part of the desert has the legs and belly black, in another white. Blyth based his species *leucopus* on a specimen from Moultan which he described as smaller than *pusillus*, light fulvous on the head and back, variegated with black and white, the cheeks, sides of the neck, flanks the inside and mostly the front of the limbs being white. Two years later he referred to the same species specimens from Hansi and Hissar, from a spot between Indiana and Ferozepore and from Cutch. The specimen from Hansi had the belly black and the legs dark, showing Blyth the inappropriateness of the name *leucopus*.

The opinion expressed by Adams [*Proc. Zool. Soc.* (1858), p. 516] that *leucopus* would turn out to be the same as *pusillus* was adopted by Blanford, who unfortunately chose the inadmissible name *leucopus*, giving it full specific rank. Mivart [*Mon. Canidae* (1890), p. 123] followed Blanford in this respect; but he was the first to detect that Blanford's *persicus* is a synonym of *leucopus*, although he quite failed to see the close kinship between *leucopus* and typical *Vulpes vulpes* and wrongly affiliated it with *V. corsac* of Central Asia, which is related to *bengalensis*. With far more material than other authors were able to examine, I have been unable to distinguish *leucopus* from *pusilla*. I have not, however, seen topotypes of *leucopus* from Moultan. But specimens from Hissar which Blyth referred to *leucopus* are inseparable from specimens from the Salt Range, the type-locality of *pusilla*. Nevertheless as the table of measurements shows, the skulls of Sind specimens appear smaller on the average than those from the Upper Punjab. I believe the differences to be merely individual. At all events the evidence that these small specimens represent *leucopus* is quite inconclusive and the intergradation is complete.

It is needless to attempt to describe in detail the very large number of skins, in the British Museum, which I assign to this race. A few will serve to illustrate the individual and seasonal differences.

Bhattu in Hissar, 6,000 ft. (Col. Stockley), November 12th. Two skins ♂, ♀ in new winter coat are tolerably uniformly rich ochreous, spangled with whitish above; flanks whitish; thighs externally and lower shoulders hoary, the contour hairs showing a white band with a black tip; tail ochreous above with black tipped hairs; fore leg dark, brownish to nearly black, with the toes paler; hind leg below hock white in front, with a dark spot on the paw; under side ashy grey, with the chin white.

Ara in the Salt Range, 2,300 ft. Two later skins (Wells), March 26th, ♀, resemble the skins from Hissar, but a ♂, March 23rd, is much less well coloured above the tint being apparently faded with the close of the winter. An adult ♂, ♀, 3,800 ft. (Stockley), July 27th, in summer coat, are very different. In the ♀ the moult is not quite complete, the ochreous-brown tint of the new hair of the back being partially obscured by old deep brown long hair, the new coat of the under side is white, but some old dusky hair is retained on the throat; the fore legs are tan, grizzled down the front; the hind legs are paler. In the ♂ the moult is completed, the colour

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above being ochreous brown, the flanks grey, the under side white as in the new coat of the ♀, but the feet are much darker.

Chakdulla, Campbellpore, 2,000 ft., in the Attock district of the Upper Punjab (Stockley). A young ad. ♀, November 17th, closely resembles the Hissar series, but is not so hoary on the shoulders and thighs and has the fore legs pale yellowish brown, the hind legs nearly the same and not strongly contrasted with the fore legs as in the Hissar skins. This skin and a ♀ from Potwar W. of Rawalpindi (Bingham), February, which is rather duller in hue, both from the extreme northern part of the range of *pusilla* in the Punjab, differ strikingly in colour from the skins identified as *griffithii* from higher altitudes in the Murrie Hills a few miles to the east and north-east.

Numerous skins from the following, amongst other localities, differ to a certain extent individually in the coloration of the upper and undersides and of the limbs and often considerably in accordance with the moult, but are indistinguishable as a whole from those above described from farther north.

Kashmor, Mirpur, Khairpur in Upper Sind, on the right and left banks of the Indus (Prater); Thar and Parker, Lower Sind; Bhuj and Nokania in Cutch (Crump); Jodhpur and Sambhar in Rajputana (Adams and Hume). Also a large number of skins collected by Sir J. E. B. Hotson at or near Khozdar and Turbat and Panjgur in Southern Baluchistan are indistinguishable from Indian skins; and the same is true of S. Persian skins, the type and topotypes of *persica* Bl. from Shiraz, one from Chahanbar on the Persian Gulf (Hotson), one from the Karun River, identified by Thomas as *flavescens* (see below), three from Baghdad (Cox and Cheesman) and one from Ctesiphon on the Tigris (Christy).

The following are the flesh measurements in English inches of the largest and smallest ♂ and ♀ examples from the principal districts arranged roughly geographically from north to south and westward:—

		Head and Body	Tail	Hind foot
Attock, Campbellpore;	yg. ad. ♀	20⅘	15⅖	5⅜
Salt Range, Ava;	ad. ♂	22⅖	15⅜	5
,, ,, ,,	ad. ♂	21⅕	14⅘	5⅕
,, ,, ,,	ad. ♀	21⅕	13⅜	5—
,, ,, ,,	ad. ♀	20⅜	14⅘	5⅖
Hissar, Bhattu	ad. ♂	21⅖	14	5⅜
,, ,,	ad. ♀	21⅘	14⅕	5⅖
,, ,,	ad. ♀	19⅕	13⅕	4⅘
Rajputana, Sambhar	ad. ♂	21¼	(11)	5
Upper Sind, Kashmor	ad. ♂	21⅜	15⅜	5⅕
,, ,, Mirpur	ad. ♀	20	12⅕	4⅜
Sind Tar, Parker	ad. ♀	19	12⅜	...
Cutch, Bhuj	ad. ♂	20⅜	13⅘	5⅕
,, Nokania	ad. ♀	19—	12⅜	4⅜
Baluchistan, Wadh	ad. ♂	22⅘	17⅜	5½
,, Mand	ad. ♂	22	16⅜	5⅜
,, Khozdar	ad. ♀	22	16⅜	5⅜
,, Panjgur	ad. ♀	20	15⅘	5⅕

The ear is only slightly smaller than in *montana*, a trifle under 3½ in. on the average.

Two flesh-measured ad. ♂ skins from S. Persia, one from Chahanbar (Hotson), the other from the Karun River, both localities being on the Persian Gulf, have the head and body 23 1/5 and 22 1/5 in. respectively; and three adult ♂ skins from Baghdad (Cox and Cheesman) are 21 1/5 in.

The only recorded weights in English lbs. are as follows:—Kashmor, Upper Sind., ad. ♂ 8 lbs.; Bhuj, Cutch, ad. ♂ 6¾ lbs.; Ara, Salt Range, 2 ♀ 5¼ and 4½ lbs.

The flesh dimensions show that this race is a little smaller on the average

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than *griffithii* and considerably smaller, sex for sex, than *montana*. The weights are also much less than in *montana*.

The skull measurements entered below show a complete overlap in size between *pusilla* and *griffithii*, but a decided inferiority on the average of *pusilla*. One interesting point emerges, namely the comparatively diminutive size of some of the foxes over a considerable area of Upper Sind. The physical conditions of the district must be less favourable to growth than elsewhere; and possibly these small foxes represent a distinct race, for which it might be thought the name *leucopus* was available. But Blyth's localities for *leucopus* were Ferozepore, Ludhiana, Hansi in Hissar, Moultan and Cutch and the foxes in the British Museum from Hissar, from Kashmor in Upper Sind, the nearest locality to Moultan, and from Cutch closely resemble examples from the Salt Range, whence the type of *pusilla* came. The desert foxes of Rajputana are also rather small, intermediate in size between those from the Salt Range and the smallest from Upper Sind.

CRANIAL AND DENTAL MEASUREMENTS OF THE LARGEST AND SMALLEST ♂ AND ♀ SKULLS OF BRITISH INDIAN EXAMPLES OF *V. V. PUSILLA* ARRANGED ACCORDING TO LOCALITY.

LOCALITY AND SEX	Cond. Bas. Length	Zygom. Width	Postorb. Width	Int. Orb. Width	Max. Width	Upper Cheek Teeth	Mand. Length	pm^4	m^1	m_1
Attock, Campbellpore yg ad. ♀	115	62	21	21	16½	53	87	11	9	12
Salt Range (Oldham) ad. ♂	127	69	17+	24+	21	60	96	12	8½	13
,, (M. Stuart) old. ♀	108	65	20	21	17½	53	84	10	8	12½
,, Ara (Stockley) ad. ♂	122	67	23	22	19	55	94	11	8	13
,, ,, ad. ♀	117	65	21	24	20	56	90	11½	9	13+
Hissar, Bhattu ,, ad. ♂	124	65	18	23	19	57	96	11	9	13
,, ,, ,, ad. ♂	117	65	19	23	20	56	88	12	9	13
,, ,, ,, ad. ♀	114	61	19	19	18	52	87	11	8	12½
Upper Sind, Kashmor ad. ♂	122	69	20	21	20	58	94	12½	9	14
,, ,, Wahi Pandi ad. ♂	110	63	21	23	18	51	...	11	8	...
,, ,, Khairpur ad. ♂	108	60	19	21	18–	49	82	10	8+	13
,, ,, Rohri ad. ♀?	105	61	22	20	17½	50	80	11	8	12½
,, ,, ,, ad. ♀?	102	59	19	20	17	48	71	10	8	12
Lower Sind, Umarkot ad. ♂	119	63	19	21+	18	57	93½	11½	9	13
Cutch, Bhuj ad. ♂	120	65	19	22	18	52	90	10	8	11
Rajputana, Jodhpur ad. ♂	112	59	23	20	18	53	86	9½	8	12
,, Sambhar ad. ♂	117	68	21	24	18½	54	90	10½	8	12
,, ,, ad. ♀	111	61	23	20	18	52	85	11	8	12
Baluchistan, Maud ad. ♂	125	(64±)	...	25	20½	60	96	11	9	13
,, ,, ad. ♀	110	60	18½	21	17	54½	83	11	8	12+
,, Wadh ad. ♂	115	65	20	22	17½	53	...	11+	8	...
,, Khozdar ad. ♀	123	65	19	21	18½	56	...	11	8	...
,, Panjgur ad. ♀	113	...	23	20	18–	55	86	12	8½	13

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Vulpes bengalensis, Shaw.

THE BENGAL FOX.

Canis bengalensis, Shaw, *Gen. Zool.,* vol. i, p. 330 (1800).
Canis kokree, Sykes, *Proc. Zool. Soc.,* p. 101 (1831).
Canis (Vulpes) indicus, Hodgson, *As. Res.,* vol. xviii, pt. 2, p. 237 (1833), (*nom. preocc.*).
Canis (Vulpes) rufescens, Gray in Hardwicke's *Illustr. Ind. Zool.,* pt. 2, pl. 3 (1833-4).
Canis chrysurus, Gray, *Charlesw. Mag. Nat. Hist.,* vol. i, p. 577 (1837).
Vulpes hodgsonii, Gray, *Charlesw. Mag. Nat. Hist.,* vol. i, p. 578 (1837).
Vulpes xanthura, Gray, *Proc. Zool. Soc.* (1837), p. 68 (published January 22, 1838; see *Proc. Zool. Soc.,* 1893, p. 437).
Vulpes bengalensis of all recent authors.

Locality of types of *bengalensis* (from Pennant), Bengal; of *kokree,* Deccan; of *indicus,* India; of *rufescens,* India; of *chrysurus, hodgsonii* and *xanthura,* Nepal.

Distribution: The whole of India from the foothills of the Himalayas, up to 4,500 ft. at Kangra, to Cape Comorin and from Sind to Eastern Bengal (Bihar and Orissa) and even to Assam according to Blanford.

Distinguished from *Vulpes vulpes* by the black tip of the tail, by the ears being the same tint as the nape or, when darker, never exhibiting the blackness characteristic of that species, by the presence of only two pairs of mammae instead of three, by the shorter, less luxuriant winter coat and the finer, closer pale speckling of the dorsal pelage. The size on the average is nearly the same as in *V. v. pusilla;* but the tail and hind foot are a trifle shorter. It is doubtful if there is any constant difference between the skulls of *V. bengalensis* and *V. v. pusilla.* They are frequently very difficult to distinguish; but the teeth of *bengalensis* are on the average smaller, the difference being more apparent to the eye than when expressed in millimetres, and the nasals are usually broader in their posterior part.

Notes on the synonymy: The fox described by Pennant as the 'Bengal Fox', which Shaw named *bengalensis,* was probably exported from Calcutta. Its locality may be fixed as the adjoining area of India, south of the Ganges. There was no precise locality for the type of *kokree* and no character to distinguish it from *bengalensis* was given. The type, ticketed the Deccan, is in the British Museum. Hodgson recorded *indicus* as occurring over the greater part of India. The type in the British Museum has no locality, but since the name was preoccupied for the Indian Jackal, the locality is of no moment. The next name *rufescens* similarly cannot be assigned to the fox of any definite locality. Hardwicke's illustration, which is the type, indicates a specimen which had moulted the black and white contour hairs and was tolerably uniformly fulvous. The names *chrysurus* and *xanthura* were given by Gray to the same specimen, a fox collected by Cobbe in Nepal. The type is in the British Museum, the skin labelled *chrysurus,* the skull *xanthura.* The type of *hodgsonii* also came from Nepal.

Colour of the dorsal surface very variable according to the condition of the pelage. When the coat is fresh and unfaded the dorsal surface and flanks are everywhere speckled with the whitish bands in the contour hairs, but the crown and the back behind the shoulders are brownish, ochreous or buff, owing to the summit of the wool and a small area between the black tip and the white band of the contour hairs being one of those tints; but these tints are absent on the flanks, which are greyish and speckled, and mostly on the nape which is typically thus contrasted with the back and crown; the muzzle is darkish but there is usually a greyish black smudge in front of the eye; the throat is white, the chin sometimes fuscous, and there is often a fuscous collar on the hind throat and a good deal of buff on the fore breast and axillae; the belly is white but the base of the tail below, the anal and genital areas and the backs of the thighs to the hocks are ochreous or rufous; the hind leg in front below the hock is whitish or some pale shade and the fore leg is rufous from the elbow externally, but greyish with a varying amount of black

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down the front usually to the wrist; the tail is mostly darkish grey owing to the black and white contour hairs which form a good brush, the black being dominant at the end to form the black tip. When the pelage is in moult or approaching it and the hairs are dead or dying the characteristic colouring described above fades away.

Although the large number of specimens collected by the Mammal Survey suggests that this species may be represented by a few local races, as might be expected from its wide distribution and varied environment, the insufficiency of series of skins collected at the same time of the year in different localities and the considerable individual variation in skins and skulls from the same locality make the definition of local races impossible for the present. If further material shows they can be established, *kokree* will come in for the Southern Deccan form, *chrysurus* for the Northern Nepalese form and *bengalensis* itself for the form from the central plains of India south of the Ganges.

Some individual and seasonal variations in the species may be shown by brief reference to a few of the skins collected for the Survey in the principal districts.

Bahgownie in Darbangha, 150 ft. Ten skins collected by Baptista between July 29th and October 21st. No two are quite alike in every respect, the extremes being collected on consecutive days, July 29 and 30. One, July 30, is a dark fox with the brown of the crown and back conspicuously speckled with black and buff, the flanks grey, speckled with black and white; the chin and throat white, a blackish collar on the hind throat, breast buffy, and abdomen whitish; inguinal region and back of thighs deep brown; hind leg below hock in front whitish, with the paw dusky; fore leg deep brown above externally, speckled black and grey down front. The other, July 29, is in poorer coat and much paler, with the contour hairs more scanty, so that the black and white speckling is much less in evidence; below the hind throat has hardly a trace of the collar, the breast is much paler buff; the inguinal area and the legs are rusty ochreous rather than brown and there is less pigmentation down the front of the fore leg. The remaining specimens are in varying degrees intermediate between these two.

Haldibari, just south of Sikhim (Crump), an adult ♀, April 13th, is moulting, the coat being thin on the body and tail and bleached so that the colour is a little paler than the palest skin from Darbangha; the belly is nearly naked in preparation for suckling.

Kangra. An adult ♀ collected by H. Whistler at Hamirpur, 2,000 ft., is undated, but evidently in winter coat, which is full, and soft and 37 mm. long; the general colour is very much as in the darkest of the skins from Darbangha. Another ♀ from the Kangra Valley (Wells), 2,000 ft., March 28th, has the same coat but is rather paler than Whistler's skin, with the black hair still less abundant, the collar smaller, the breast less richly buff, the inguinal region and back to the thighs paler ochreous and the fore leg with much less black down the front. A third ♀ from Gopalpur, 4,500 ft. (Wells) March 13th, is like the last in colour below and on the legs, but the coat is not so full as in either of the others, despite the greater altitude, and the colour of the back is yellower and less speckled with black and white.

Gwalior. A series collected by Ryley O'Brien at Binganj, October-November, consists of mostly darkish, rich coloured skins tolerably closely resembling the darkest skins from Kangra and Darbangha but with the coat, owing to the season, fuller and longer than in the latter.

Sind (S. H. Prater). An ad. ♂ from Gangra Mithi Tal, Thar Parkar, October 4th, agrees in colouration with the average of the series from Darbangha. An ad. ♂ and ♀ from Mirpur in Sukkur, March 26th and 27th, are in moult and faded, showing only a pale buffy wash on the fore quarters and a more ochreous tint on the rump, the flanks are pale grey or dirty white, and there is little speckling on the fore legs. The ♀ which was suckling has the abdomen covered with short red hair. A ♀ from Khot Diji in Khairpur, April 10th, although in better coat is a close match of the two Sukkur skins. Another ♀ from Gambat in Khairpur, April 15th, has hardly a trace of buff or ochreous above, merely a faint wash on the hind back but the dorsal surface and flanks are darker than in the other March and April skins from Sind owing to there being more black in the contour hairs.

Deccan. Dharwar, 2,500 ft. (Shortridge). An ad. ♀, January 8th, in good

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coat, about 30 mm. long, has an ochreous wash down the back, spangled with white but with no black tips to the contour hairs, so that the dorsal colouration is paler than usual; the ears, however, are exceptionally dark and more strongly contrasted with the head and nape than is normally the case; there is a small darkish collar on the hind throat and some ochreous on the breast. This specimen has the belly moulted for suckling, a condition which in more northern specimens occurs later, at the end of March or beginning of April. An ad. ♂ from the same locality, 1,900 ft., December 21st, is very like the ♀ but has some black speckling in the coat.

Kurnool (Baptista). An ad. ♂ from Diguvameta, April 25th, has a thin short faded coat of dead hair with no wool and a pale grey sepia wash, speckled with buff, on the back. An ad. ♀ from Malakondapenta, May 19th, also has a thin short coat with no wool, but a brownish wash on the back and the shoulders and nape speckled black and white.

High Wavy Mountain in Madura, near the borders of Travancore (S. H. Prater). Two, June 8th, are in faded, thin summer coat, showing no distinctive characters. They are worth recording as the most southern examples of the species procured by the Survey.

Flesh measurements in English inches of the largest and smallest ♂ and ♀ specimens, where known, from the principal districts, are as follows:—

		Head and Body	Tail	Hind foot
Darbangha	ad. ♂	21½	11⅜	5
,,	ad. ♂	20⅝	10¼	...
,,	ad. ♀	20	10⅜	4½
Kumaon	ad. ♂	20⅝	11½	4¼
,,	ad. ♂	19⅝	11½	4⅜
Kangra	ad. ♀	23⅜	11⅜	4½
Gwalior	ad. ♂	24½	12¼	4⅜
,,	ad. ♂	21⅞	11¼	4⅝
,,	ad. ♂	22⅜	13	4⅝
Sind, Thar Parkar	ad. ♀	19⅜	12¼	...
,, Mirpur, Sukkur	ad. ♂	17¾	9¾	4
,, ,, ,,	ad. ♀	18⅜	11½	4⅜
,, Gambat, Khairpur	ad. ♀	19⅝	11⅝	4⅜
Deccan, Kurnool	ad. ♂	19⅜	12	4¼
,, ,,	ad. ♀	20⅜	12	4¼
,, Dharwar	ad. ♂	20½	12	4⅜
,, ,,	ad. ♀	20	14	4¼

The average length of the ear is 3 in.

The weight is from about 6 to 8 lbs. in adult males.

The measurements are on the whole tolerably uniform throughout the range of the species, although the single measured specimen from Kangra and the specimens from Gwalior, of which only the largest and smallest males are entered, appear to be larger than those from other districts. But since this is not borne out by any superiority in the size of the skulls, I suspect it is due to the 'personal equation' of the collectors. The exceptionally small adult ♂ from Mirpur, in Sind, is referred to below under the skulls.

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Skull Measurements of the Largest and Smallest Adult ♂ and ♀ Specimens, where known, from each of the Principal Districts.

Locality and Sex	Cond. Bas. Length	Zygom. Width	Postorb. Width	Int. Orb. Width	Max. Width	Upper Cheek Teeth	Mand. Length	pm^4	m^1	m_1
Nepal (*chrysurus* type)										
ad. ♂	(117±)	68	18	22	20	52	90	10	$8\frac{1}{2} \times 10\frac{1}{2}$	$11\frac{1}{2}$
ad. ?	110	63	22	21	21	49	...	9	8 × 10	...
,, ad. ♂	117	68	20	23	19	51	91	$9\frac{1}{2}$	8 × 11	11
Darbangha ad. ♂	116	69	21	24	20	53	89	9+	8 × 11	11
,, ad. ♂♀	110	65	20	21	$17\frac{1}{2}$	49	84	9	$8 \times 10\frac{1}{2}$	11
,, ad. ♀	104	59	20	20	18	47	80	9	8 × 10	11
Kumaon ad. ♂	114	66	19	23	$18\frac{1}{2}$	52	90	10	8 × 11−	12−
,, ad. ♂	106	60	20	20	18	48−	$80\frac{1}{2}$	9	8 × 10	11
,, ad. ♀	109−	63	22	23	18	50	85	10−	8 × 11−	12
Kangra, Gopalpur old. ♀	111	64	20	21	17	50	87	9	7 × 9	10
,, Hamirpur old. ♀	108	62	20	19	19	48	82	10	$8\frac{1}{2} \times 12$	12
,, Valley old. ♀	103	57	21	19	17	46	76	$9\frac{1}{2}$	8 × 10	11−
Gwalior, Binganj ad. ♂	115	65	22	23	19	52	87	9	8 × 10	$10\frac{1}{2}$
,, ,, ad. ♂	108	62	20	20	17	50	82	9	$7\frac{1}{2} \times 9\frac{1}{2}$	11−
,, ,, ad. ♀	110	58	18	18	16	51	83	10	8 × 10	11
Sind, Thar Parkar ad. ♂	(111±)	64	21	22	18	50	84	9	8 × $9\frac{1}{2}$	11
,, Mirpur, Sukkur ad. ♂	92	59	20	19	16	40	70	8	6 × $8\frac{1}{2}$	10
,, ,, ,, ad. ♂	105	60	19	20	18	47	80	9	7 × 9	10
,, Gambat ad. ♀	102	57	18	18	$15\frac{1}{2}$	46	76	9	7 × 9	10
,, Kot Diji ad. ♀	100	56	19	18	15	46	76	9−	8 × $9\frac{1}{2}$	$10\frac{1}{2}$
Deccan (*kokree* type) ad. ♀	103	53	20	19	16	46	79	9	7 × 9	10
,, Kurnool ad. ♂	110	61	20	20	17	52	85	10	8 × 10	$10\frac{1}{2}$
,, ,, ad. ♀	115	$61\frac{1}{2}$	19	20	17	...	89	10−	$8\frac{1}{2} \times 10$	11−
,, Palkonda Hills ad. ♀	108	$57\frac{1}{2}$	19	19	17	50	84	$9\frac{1}{2}$	8 × 10	10
,, Dharwar ad. ♀	(117±)	62	19	18	$16\frac{1}{2}$	50	86	9	8 × 10	11
,, ,, ad. ♀	107	61	19	19	$16\frac{1}{2}$	49	...	9	8 × 10	...

Two facts connected with this table stand out as particularly instructive instances of individual variation in the skulls of this fox. The first is the difference in the size of the teeth exhibited by the two ♀ skulls from Gopalpur and Hamirpur in Kangra. Both are old with the teeth about equally worn, yet the first upper molar (m^1) of the skull from Hamirpur, collected by Mr. H. Whistler, is wider than the same tooth in any other skull of the species I have seen. In the Gopalpur skull, on the contrary, that tooth is rather exceptionally small. Its lower carnassial (m_1) also is considerably smaller than in the skull from Hamirpur. In the third ♀ Kangra skull the teeth are about average in size and intermediate between the other two.

The second point is the exceptionally small size of the ad. ♂ skull from Mirpur, Sukkur in Sind. It is hardly longer in condylobasal length than Blanford's Fox (*V. cana*) from Baluchistan, although much more robust, and is much shorter than the ♀ skull from Mirpur collected at the same time by S. H. Prater. The ♂ skull must be regarded as that of a dwarf,[1] and

[1] It will be remembered that some of the skulls of *V. vulpes pusilla* from Sind are exceptionally small.

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the dwarfing has affected the upper carnassial (pm^4) and the first upper molar (m^1) as well. The other ♂ skull from Sind, from Thar Parkar, has an estimated condylobasal length of 111 mm. which is the same as the average of 5 ♂ skulls from Gwalior, and of 6 ♂ skulls from Kumaon, but the average of 4 ♂ skulls from Darbangha is 116 mm.

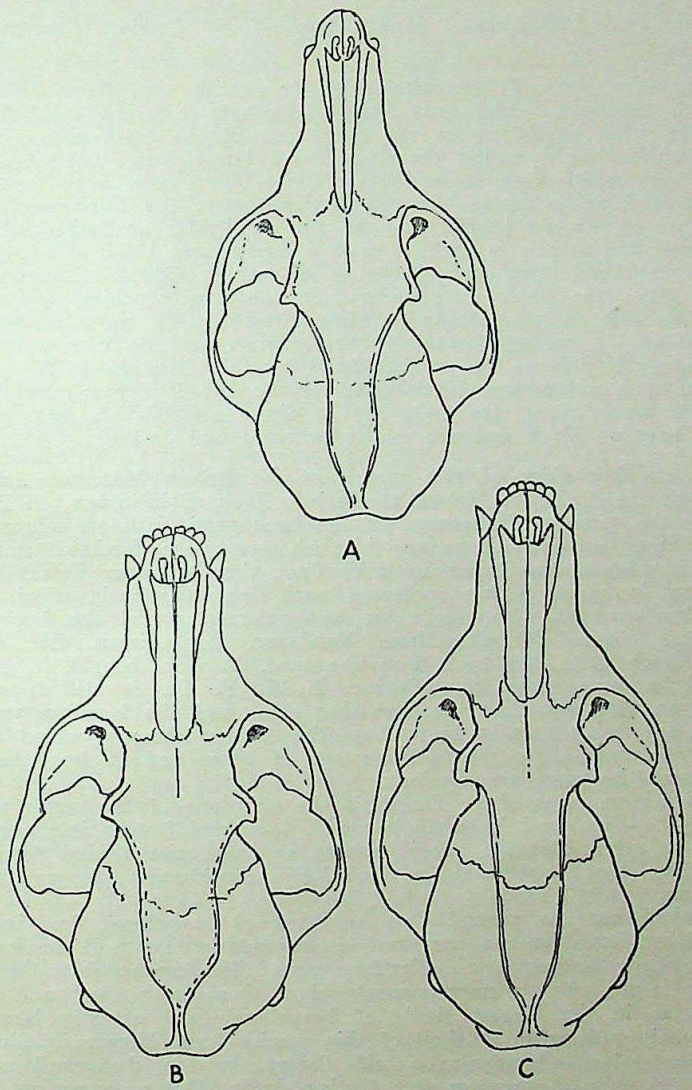

Fig. 2.—A. Skull of type of *Vulpes cana* from Gwadar.
B. Skull of dwarf ♂ of *Vulpes bengalensis* from Sukkur, Sind.
C. Skull of normal ♀ of *Vulpes bengalensis* from Sukkur, Sind.
All ×⅓.

Vulpes cana, Blanf.

BLANFORD'S FOX.

'The Small Afghan Fox of Griffith', quoted but wrongly identified by Blyth, *Journ., As. Soc. Beng.*, vol. xiv, p. 344 (footnote) (1845).

Vulpes canus, Blanford, *Journ., As. Soc. Beng.*, vol. xlvi, pt. 2, p. 321 (1877); Sclater and Alston, *Proc. Zool. Soc.*, p. 392 (1878).

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Vulpes cana, Blanford, *Mamm. Brit. Ind.*, p. 150 (1888); Ognev, *Ann. Mus. Nat. Hung.*, vol. xxiii, p. 238 (1926).

Vulpes cana var. *nigricans*, Shitkow, *Zool. Anz.*, vol. xxxii, p. 448 (1907).

Locality of the type of *cana*, Gwadar, Baluchistan; of *nigricans*, Bokhara in Turkestan.

Distribution: Baluchistan, Afghanistan, N.-E. Persia (Khorassan) and Turkestan.

Distinguished from *V. bengalensis* by its smaller size, much fuller, softer and more luxuriant winter coat and by its very different colouration; the coat when fresh exhibiting on the back none of the black and ochreous or buff or white close speckling characteristic of *bengalensis*. The contour hairs of the back, which vary from 45 to 65 mm. in length, have an extensive black tip and an extensive silvery subapical band; the thick wool, varying from 35 to 45 mm. in length, may be grey or lighter or darker ochreous at its summit; the muzzle is darkish, with a conspicuous black smudge in front of the eyes; the crown and cheeks to a varying extent silvery; the ears blackish grey; the flanks and under side are mostly white, but the chin may be blackish and there may be some infuscation on the hind throat and some buff on the breast; the tail is mostly grey, overcast with the extensive blackness of the tips of the contour hairs ranging from 65 to 90 mm. long and forming a voluminous black-tipped brush; the legs are mostly darkish grey, with some black, the ends of the digits are whitish, but sometimes the legs have no black and are mostly ochreous and cream.

There are four skins of this species in the British Museum. An ad. ♂ collected by Sir J. E. B. Hotson at Turbat, Kech, Baluchistan, on December 13th, has the summit of the wool of the back grey, with an ochreous wash in it on the nape; the legs are blackish grey; the forehead and cheeks silvery. Blanford's type taken 15 miles from Gwadar, near Kelat, Baluchistan, differs in having a faint ochreous wash down the back, which is more silvery, less overcast with black; the legs paler grey and the forehead and cheeks less silvered. A skin from Kandahar, Afghanistan, has a richer ochreous wash down the back than the type. A skin bought in Peshawar and said to have come from Bezaur, N.-W. F. P., is still more richly ochreous on the back than the Kandahar skin, and the legs are very pale, the fore leg being creamy grey down the front, ochreous behind and the hind leg ochreous above the hock, instead of grey, and in front below the hock cream (the paws are missing).

The specimen collected at Turbat is the only one of the series measured in the flesh:—head and body, 16 in.; tail, —;[1] hind foot, 4 in.; ear, 3½ in. It may be noted that the ear is almost as long as the hind foot and is actually as long and therefore relatively considerably longer than in *bengalensis*.

The skull has the general shape of that of *bengalensis* but is smaller and, judging from the two examined, is muscularly less well developed, the temporal ridges forming a wide lyriform area. The carnassial teeth are relatively larger. As the measurements show these teeth (pm^4 and m_1) are as large as in the biggest skulls of *bengalensis* and actually larger than in the smallest dwarfed ♂ skull of this species from Mirpur in Sind. The first upper molar (m^1) is also a trifle larger than in that skull and very nearly if not quite the average size of other skulls. But a comparison between the general dimensions of the dwarf ♂ skull of *bengalensis* from Mirpur and the two of *cana* shows that although they are all of approximately the same condylobasal length, the *bengalensis* skull is more strongly developed, being broader across the zygomata and across the muzzle at the canines. A noticeable individual difference between the two skulls of *cana* is seen in the nasals which in the skull from Turbat are exceedingly narrow behind whereas in the type they are broader, although not so broad as in the average of *bengalensis*.

[1] Hotson gave the tail as 135 mm. (=5 2/5 in.), but half of it is missing. In other made-up skins the tail is at least two-thirds the length of the head and body.

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Vulpes ferrilata, Hodgson.

THE TIBETAN DESERT FOX.

Vulpes ferrilatus, Hodgson, *Journ., As. Soc. Bengal*, vol. xi, p. 278, pl. (1842); Blanford, *Mamm. Brit. Ind.*, p. 155 (1888); Bonhote, *Proc. Zool. Soc.*, p. 303, fig. (skull) (1905).

? *Canis eckloni*, Przjevalski, *Third Journ., Centr. Asia*, p. 193 (1883), (*nom. nud.*).[1]

? *Alopex eckloni*, Matschie in Filchner's *Exped. China and Tibet, Zool.*, p. 171 (1907).

Locality of type of *ferrilatus*, near Lhasa; of *eckloni*, Mongolia.
Distribution: Tibet, Nepal and the Upper Sutlej Valley.

Hodgson's skins from Nepal and a living example from that country exhibited in the Zoological Gardens, all referred to below, may have been brought to Nepal from Tibet. Stoliczka's record of the species from the Upper Sutlej (*Journ., As. Soc. Beng.*, xxxvii, pt. 2, p. 5) may be due to an erroneous identification of a specimen of *V. vulpes montana*, although it was associated with some typical Tibetan species.

Distinguished from the previously described species by its relatively much smaller ears, its shorter tail, its very thick but comparatively short and rather wavy winter coat and by several striking differences in the skull and teeth. Coat consisting of an intimate mixture of the contour hairs, which have a pallid subapical band, and the wool, the two being approximately equal in length and varying in length from about 25 to 40 mm., no doubt in accordance with the winter date; but interspersed in this coat, sometimes very sparsely, sometimes tolerably abundantly, are numbers of longer, fine black hairs up to 50 mm. or more in length. General colour above from the head on to the root of the tail ochreous from the tint of the tips of the contour hairs and the summit of the wool, speckled by the pallid areas of the contour hairs but hardly appreciably darkened by the long erect black hairs; the head often not so bright, greyer; the muzzle with no trace of a fuscous patch in front of the eye; the ears not sharply contrasted with the nape, but sometimes a little darker; a clear buff patch behind the ear. Sides of the neck, flanks and thighs hoary; tail dark grey, mixed black and white sometimes with a buffy tinge above; the tip extensively white; hind leg ochreous above the hock and down the back of the metatarsus; white in front below the hock; fore leg from the elbow ochreous, or palish buff with white paws and sometimes a fuscous patch on the wrist; upper lip, chin and the rest of the under side white, with the white of the hind throat set off on each side by a large fuscous patch.

This description is taken from six specimens in good coat, namely a recently received, mounted specimen from Tibet (R. Ward); two lectotypes from Lhasa (Hodgson), one from Eastern Central Tibet (Thorold) and two ticketed Nepal (Hodgson). Two younger skins, ticketed Nepal (Hodgson), are paler, either greyer or buffier than the rest, not so ochreous. But a skin from the Karo La Pass, 16,600 ft. is in full moult and differently coloured. Most of the contour hairs of the back are shed, those that remain having

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[1] This name was given by Przjevalski apparently to the Steppe Fox he identified as *Canis corsac* in 1875 in his *Mongolia and the Land of the Tongouts*. According to Delmar Morgan's translation of this work, vol. ii, p. 211, 1876, Przjevalski referred to this fox as occurring over the whole of Mongolia, Kansu, Kokonor and Tsaidan, being especially plentiful in the plains round Kokonor. But he secured no specimen and merely recorded what he knew of its habits; and no description was given when he altered the determination and named the fox *Canis eckloni*. I should not have quoted the name in this connection but for the reference to it as *Vulpes ferrilatus eckloni* by Ognev, who presumably took his opinion from Matschie's identification of *eckloni* and his comparison of it with *ferrilatus*. Matschie, however, assigned *eckloni* to the genus *Alopex* of which the type is *lagopus*, and *corsac* has a good deal of resemblance to *lagopus* in skull characters. On the other hand in the whole Vulpine series of species it would be impossible to find two with the skulls more different than *lagopus* and *ferrilata*.

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dead shrivelled tips; the wool is close and matted, about 25 mm.; the general colour is browner, not so ochreous and is conspicuously more blackened by the long black hairs; the tail has no contour hairs but is covered with soiled, felted wool.

None of the above described skins is dated or was measured in the flesh; but the following are the dimensions in English inches of the specimen mounted by Rowland Ward; head and body, 26½ in.; tail, 11¼ in.; hind foot, 5 in.; ear, 2 1/5 in. The ear of the skin from the Karo La Pass, when softened, was 3 mm. longer.

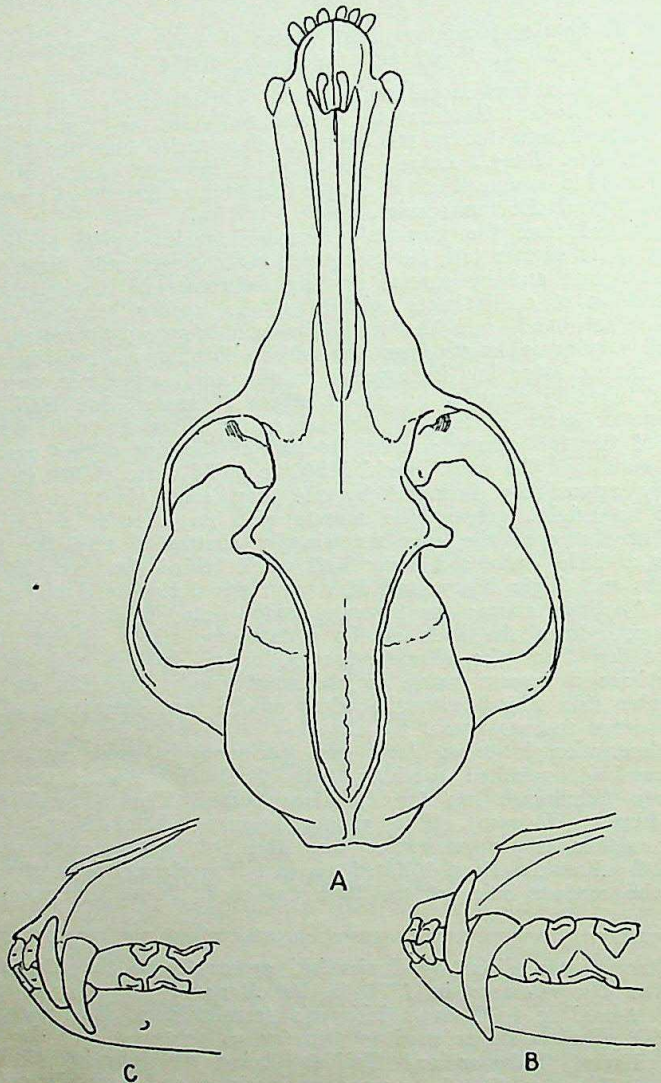

Fig. 3.—A. Skull of ad. ♂ of *Vulpes ferrilata* from Karo La Pass, Tibet.
B. Front end of jaws of the same from Gyang-tse, Tibet.
C. The same of *Vulpes vulpes montana* from Takula, Kumaon.

Incidentally these measurements disprove Blanford's statement that *V. ferrilatus* is considerably less in size than *V. vulpes montana;* but they show that the tail, without the hair, is less than half the length of the head and body, instead of over, and that the ear is about 1 in. or more lower. These differences also distinguish *V. ferrilata* from *V. bengalensis* and *V. cana.*

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The very remarkable skull of this fox, which in its development is an extreme exaggeration of the Vulpine type, was unknown to Blanford and was first described by Bonhote who pointed out many of its peculiarities. The skull is longer in its condylobasal length, and in the length of the mandible and of the upper cheek-teeth than any of the skulls of *V. v. montana* I have seen; but the difference is due to the exceptional length of the jaws, the cranial portion, although it has rather wider zygomata, being actually shorter on the average. The jaws, however, are not only longer but narrower, being actually narrower by about 3 mm. above the second premolar than in a large skull of *montana*, but they expand above the canines where the width is about the same as in *montana*. The forehead is concave from side to side owing to the uplift of the postorbital processes. There are also differences in the teeth, the most noticeable being the extreme length of the canines in *ferrilata* in which the upper canine, when fully erupted and unworn, is 5 mm. longer down its anterior edge than the corresponding tooth in *montana*.[1] The lower canine is similarly higher and the upper premolars (pm^1 to pm^3) and the lower premolars (pm_1 to pm_4) are longer from back to front; but whereas the upper carnassial (pm^4) and the lower carnassial (m_1) are subequal to those of *montana*, the first upper molar (m^1) of *ferrilata* is smaller. From these differences it results that in *ferrilata* the height of the upper canine exceeds the combined lengths of the upper carnassial and the first molar, as set in the jaw, and that the third upper premolar is longer than the first molar. In *montana*, on the contrary, the canine is much less than the other two teeth and the third upper premolar is shorter than the first upper molar.

CRANIAL AND DENTAL MEASUREMENTS OF THE AVAILABLE SKULLS OF *VULPES CANA* AND *VULPES FERRILATA*.

NAME, LOCALITY AND SEX	Cond. Bas. Length	Zygom. Width	Postorb. Width	Int. Orb. Width	Max. Width	Upper Cheek Teeth	Mand. Length	pm^4	m^1	m_1
Vulpes cana										
Turbat, Baluchistan ad. ♂	91	50	19½	18	13	43½	69	10	7½ × 10	11
Gwadar ,, ad.	89	50½	18	19	13	41½	67	9½	6½ × 9	11
Vulpes ferrilata										
(Nepal) ad. ♂	152	86	24½	27	25	75	124	13	8½ × 12	16—
Tibet, Karo La Pass ad. ♂	145	83	26	24	23	75	118	13	8½ × 11	15
,, Gyangtse ad.	145	82	24—	24	25	70	116	13½	7½ × 12	15
,, E. Central yg. ad.	144	(72±)	22½	21	22	71	115	13	8 × 12	14½

Of the skulls of *ferrilata* entered on this list the first bracketed Nepal came from a living specimen presented by the Maharajah of Nepal to the present King Edward, when Prince of Wales. It has no skin and its locality is doubtful. The one from the Karo La Pass, collected by Col. Waddell, was figured and described by Bonhote. The one from Gyangtse, which has no skin, was received from Col. F. M. Bailey and the one from E. Central Tibet was presented by Mr. W. Thorold.

[1] Bonhote recorded the canine of the skull from the Karo La Pass as 29 mm. and that of his type of *waddelli* as 20 mm. The latter is correct; but the former number is a misprint for 25.

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THE SNAKES OF DEOLALI.

With Notes on their comparative Osteology and peculiarities of Dentition.

BY

A. G. L. Fraser, I.M.D.

Part I.

(With 2 plates and 2 text-figures).

Introduction.

This paper is the outcome of a study, which in its initial stages had been restricted to identification, with a view to listing the families and species appearing from time to time in this locality. For this purpose a collection was begun in Deolali. When the limits to the numbers of the prevailing local species seemed to have been reached and no further fresh material was forthcoming, the study was amplified so as to include the more important features connected with the differences in the osteology and dentition of those members of the sub-order *Ophidia* met with in Deolali.

The work undertaken has occupied the greater part of the author's leisure period for a little over two years. The results have amply repaid the time and labour involved and the study itself has afforded much instruction and entertainment. It is thought that the data collected and now presented may serve some useful purpose by their publication; as the subject is one in which, but few are seriously interested. Further the existing literature available on the points of osteology and dentition is scarce—some of the publications having been long out of print—and hence so costly as to put them beyond the reach of many, who perhaps would become interested were they able to procure such books for reference. Again the necessity for surveys of this kind need hardly be emphasised, as they not only furnish a more intimate and permanent record, but add considerably to our knowledge of the distribution of the various species.

The subject has been approached from the view-point of an interested student and amateur field worker. By combining the study of such authoritative publications as have been available along with the first-hand information found in the field, the writer has endeavoured to gather as many practical data as possible about those animals.

For the better comprehension of the text of this paper, it was considered advisable to support it with many illustrations. No apology is necessary for their profuseness, as without these aids it would not be possible for the reader to readily follow and appreciate the morphological characters and more especially the divergent features existing and helping toward separating out the

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families, genera, and species. Great care has been exercised in the correct delineation of the peculiarities both in the case of the skulls and vertebrae, by enlarged scale drawings in black and white, featuring all the details in the original bones. These, again, have been photographically reproduced so as to make the final pictures look quite natural.

This paper will deal with a total 22 species belonging to four families, which have so far been investigated on the points of external characters. The osteology and dentition of 20 of these have been dealt with and will be found described in the notes which follow. For purposes of comparison 2 species extraneous to Deolali have been included in the total shown above. Of these, one is from Bengal and the other from Mahableshwar (Deccan). The latter one was imported into Deolali under peculiar circumstances and will be referred to again later.

A table has been compiled showing the cranial and vertebral column measurements of the species described. This table also shows the ratio of growth occurring in skeletons of specimens of varying length and ages. As regards the vertebral column, it has been found possible to group the snakes according to the differences noted in the formation of their vertebrae. This vertebral grouping is of great interest, and the table of variations depicts the natural series into which they fall.

The literature which has been studied will be fully quoted at the end of this paper, but special mention must be made of three valuable publications from which great help was derived:—(1) *A Catalogue of Snakes in the British Museum*, by Dr. G. A. Boulenger (1893-6), vols. i, ii and iii; (2) *The Thanatophidia of India*, by Col. F. Fayrer (1872); and (3) *Animaux venimeux et Venins*, by Mme M. Phisalix (1922), tome ii. The first of these was perused at the Bombay Natural History Society library rooms, Bombay, in an incomplete way during the brief respite of a few hours while on a short visit to that city. The two latter were made available for study through the kindness and courtesy of Mr. S. H. Prater, Curator of the Bombay Natural History Society, to whom the author is indebted for the privilege. The book *How to identify the Snakes of India*, by Col. F. Wall, C.M.G., I.M.S., has been found particularly useful and a very excellent practical guide to the identifications of snakes from their scale formation. The synopses and keys furnished therein are reliable aids to students, especially for those who have not the time for the labour involved in reducing to skeletons the specimens they wish to differentiate in a complete way.

Geographical Location, Meteorology and Physical Features of the Station.

Devlali or Deolali, the latter name is more popularly used, is a small Military Cantonment in the Nasik Civil Collectorate of the Bombay Presidency.

The height above the mean sea level is from 1,800 to 2,300 ft. The average rainfall is 30 in. The monsoon months are June,

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July, August and part of September. The hottest months of the year are March, April and May, with the maximum shade temperature fluctuating between 100 and 110°F. The coldest months are December and January, when the minimum shade readings vary between 44 and 60°F.; the average mean being about 85°F. Dry and Wet bulb registrations show a marked humidity during October.

The topography of the country in the environs is undulating in character. On the south side lie the Thal Ghat extensions running east and west. The land is for the most part under cultivation, and is intersected by deep tributary 'Nallahs' draining into the river 'Darna', which meanders through east of the Cantonment in a north-easterly direction to a point some ten miles east of Nasik City, where at 'Darna Sangava' it joins the sacred river Godaveri.

In order to obtain precise data as to the Ophidia present, 195 specimens collected over a period from December 1932 to January 1935 were examined and revealed evidence of 4 families and 20 species in an area roughly comprised within a 5-mile radius from Devlali Railway Station (G. I. P. R.). In this area lie the villages of Bagoor, Wadner, Nanegaon, Vehitgaon, Sansari, Deolali, Shigwa and the Nasik Road sector.

Included in the previously quoted figures is a collection of 45 snakes kindly sent to me by Mr. Fenton-Bailie, House-Master, Barnes High School, Deolali. His collection contained of the known poisonous groups fatal to man, 2 Cobras, with several young ones, 4 Kraits, 5 Saw-scaled Vipers (*Phoorsa*), and 1 Russell's Viper. All of his specimens were gathered in over a period of several years in the precincts of the Barnes High School, which is within the area specified.

A second collection belonging to Rai Sahib A. G. Gokhale of the Government Distillery, Nasik Road, who very kindly accorded me facilities for viewing it, contained 1 additional species labelled *Polyodontophis collaris*. There was neither time nor opportunity for closely examining the basic characters of this specimen. The particular label affixed to it is at variance with the habitat cited by authoritative writers on the subject, who show the distribution as Himalayas, Bengal, Assam (Wall, F., 1923)[1]; Himalayas and Assam (Phisalix, M., 1922).[2] Rai Sahib Gokhale is himself uncertain as to its identity. The colour markings correspond with those of *Polyodontophis subpunctatus* and 1 specimen of this species had already been secured in Deolali. As the specimen had been in spirit apparently for a very long time, no reliance could be placed on the colour. This collection however is excluded from the numbers personally examined, and it is mentioned only to show that, with one doubtful exception, it agrees with the findings at Deolali.

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[1] *How to Identify the Snakes of India,* by Col. F. Wall, C.M.G., I.M.S., 1923.

[2] *Animaux venimeux et Venins,* by Mme. M. Phisalix, 1922, tome ii.

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The listed series tabulated in this paper can be considered fairly representative of the types met with in the area, but course cannot be so comprehensively complete as to include the whole of the Nasik Civil Collectorate. The hilly tracts of the district possibly do harbour other species. If the Deolali findings are compared with those ascertained by Col. Gharpurey, I.M.S.,[1] to be in Ahmednagar, in the adjacent Collectorate, the list for that area shows 1 added species, namely, *Eryx johnii*, whereas *Polyodontophis subpunctatus* and *Dryophis mycterizans*, which are rare snakes here have not been encountered by Col. Gharpurey. Except for these differences the two lists are identical.

General Morphological Features.

As a preliminary to the systematic description of each snake, it is necessary for our purpose, to give a brief synopsis of the general Ophidian characters as also the peculiarities which help to separate out the families and species, terrestrial, arboreal and aquatic; and so serve for their identification and classification.

A. Common Characters.

(1) The endoskeleton is encased in a scaled exoskeleton, which is devoid of any appendicular parts.

(2) The bodies are all elongated, but vary in shape and size.

- (*a*) They may be of uniform rounded thickness throughout, built stoutly or slenderly without any delineation between the head and body or tail.
- (*b*) A slender neck demarcating the divisions between the head and body, both of which may be lightly built or massively formed.
- (*c*) Small heads connected by slim necks to bodies anteriorly thin, but posteriorly broadly built and equipped with flattened tails to facilitate progression through water.

(3) Tails of various kinds:—

- (*a*) Rounded, much abbreviated, dumpy and stout or thinning out abruptly.
- (*b*) Slightly compressed, much attenuated and fine (whip-like).
- (*c*) Flattened dorso-ventrally and adapted to act as paddles.
- (*d*) Equipped with rattles.

(4) Heads may be rounded, flat, ovate or triangular with or without loreal pits and horns.

(5) Muzzles acutely pointed, obtuse or squared.

(6) Nares placed laterally or superiorly behind the rostral (snout shield).

(7) Eyes covered with the antocular membrane, but lidless. Pupils, spherical or elliptical spindles placed in the vertical or horizontal positions.

(8) No external evidence of an auditory apparatus and no tympanic cavity.

(9) Tongue bifid and contractile.

(10) The flexibility and extensibility of the ribs, which in conjunction with the transverse plates or ventrals of the belly secure mobility and locomotion.

(11) The generative organ in the males is paired.

(12) The *Ophidia* are either oviparous, laying soft ovate eggs ordinarily hatched by the heat of the sun, or the warmth generated by fermentative processes set up in decaying vegetation; or ovo-viviparous, that is the eggs are incubated within the body and the young emerge alive and fitted for an independent existence.

(13) The red blood corpuscles are nucleated biconcave discs.

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[1] 'Snakes in Ahmednagar', by Lt.-Col. K. G. Gharpurey, I.M.S., *Journ., Bombay Nat. Hist. Soc.*, vol. xxxvi, No. 1, p. 272 (15th November, 1932).

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B. Classification.

There are about 1,700 species of snakes in the world (Manson, 1921).[1] Their identification and classification into 9 main family groups and their further separation into sub-family divisions, genera and species is based upon a study of:—

(1) (*a*) Head shields or scutae. Their presence and arrangement or their absence.
(*b*) Loreal pits and horns on the head or their absence.
(2) The costal scales:—Their size, shape, arrangement and number.
(3) The ventral plates:—Their size, width and number; or their absence.
(4) Anal shield, whether entire, divided into two or further subdivided into three sections.
(5) Subcaudal plates, whether entire or divided throughout or only partially so.
(6) Mental sublingual shields, whether present in one pair alone, or in two or three pairs.
(7) Tails, whether rounded, slightly compressed or flattened dorso-ventrally.
(8) Colour. This is not an accurate guide as there are variations even in the same species.
(9) Design. The pattern of the markings are a more constant feature in the adults, but the young of certain species differ markedly from the adult.
(10) Rudimentary limbs. Concealed vestiges of hind limbs below and near to the cloaca, peculiar to the sub-family *Pythoninae*.

The foregoing are the external characters. Their accuracy is considered of questionable value in distinguishing species, because of the aberrant types frequently met with. The more important fundamental differentiations rest upon the formation of the skull; the shape, size and position of the maxilla; the absence or presence of certain bones in the skull and chiefly the peculiarities of the dentition, which most of all facilitate the separation of the *Thanatophidia* or poisonous snakes. The known poisonous species belong to either of two families, namely, *Colubridae* and *Viperidae*. These are recognised by the size, length and position of the maxilla, which in the former is long, thin and horizontally positioned and in the latter short, thick and obliquely set.

The world *Colubridae* number some 1,300 (Manson, 1921),[1] and form the largest family of the sub-order Ophidia. They are divisible into three groups according to the peculiarities of their dentition. The presence of large infolding canaliculated recurved fangs placed in the forward position attached to the maxilla, denote the class known as the *Proteroglypha* (front-fanged). If situated posteriorly as the last in the maxilla series of teeth and grooved on their anterior aspect as well as recurved, they belong to *Opisthoglypha* (back-fanged). The third group comprises species in which the teeth are all solid and which are classed as *Aglypha*. There are further distinctions in the sub-families *Elapinae* and *Hydrophinae*, and the species in these sub-divisions are distinguished by the nature and setting of the teeth in the various situations in the roof of the mouth and the mandibles.

The poison fangs proper attain formidable proportions in some of the *Thanatophidia* and are connected by ducts to specialised

[1] *Manson's Tropical Diseases*, edited by P. H. Manson-Bahr, 1921, p. 874.

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poison glands in the *Proteroglypha* and the *Viperidae*. In the latter the poison fangs are comparatively larger and better developed and attached to a vertically fixed maxilla. The poison of certain species in the first 2 families cited above, if injected in lethal doses, has been established as dangerous and fatal to man and the higher animals.

The *Opisthoglypha* possess a parotid gland, which secretes a toxin not definitely ascertained or known to be potentially fatal to the higher vertebrates. The *Aglypha* have solid teeth and homologous glandular structures secreting a venom, which, as in the *Opisthoglypha*, kills small mammals, birds, reptilia and amphibia.

The dentition in the case of the seven remaining families, namely, *Typhlopidae*, *Glauconiidae*, *Uropeltidae*, *Ilysiidae*, *Xenopeltidae*, *Boidae* and *Amblycephalidae* shows in some the presence of teeth in the premaxilla (intermaxillary), or the provision of a lesser number of teeth, or the absence of them in certain situations. All of the teeth in these are solid. These snakes do not assume the importance attached to those in the higher specialised categories mentioned, as they are believed to be innocuous; because the majority of them are possessed of small glandular structures in proportionately small heads and being devoid of grooved fangs can neither secrete enough venom nor inject it in a quantity great enough to act in a lethal way in man. There is actually no rigid division between the known poisonous snakes and other species. It can be accepted in a general way that all snakes are provided with some form of poison apparatus, variously graded and adapted to suit their needs for securing prey or for defensive or digestive purposes. The lethal and toxic effects of the venom from a number of species have been amply demonstrated in the laboratory by many investigators.

The *Viperidae* in the world number about 110 species (Manson, 1921)[1] and are divided into two sub-family groups, the *Viperinae* and the *Crotalinae*. The latter constitute the class which show a sensory uveal pit situated between the eye and the nostril. All of these are potentially venomous and certain species are known to be dangerous.

There are about 330 recognised species of snakes in India and Ceylon (F. Wall, 1928),[2] including the *Hydrophinae* or marine snakes characterised by their paddle-like tails. These number 29 species found in the Indian seas. They are all poisonous and the venom has been variously estimated by laboratory procedure to be of a higher potency than any of the terrestrial *Thanatophidia*, which number 39 (F. Wall, 1928).[2] As has been previously stated, these belong to either of the two families *Colubridae* and *Viperidae*. In Deolali 4 families and 20 species are represented; and it will be noted that some of the well known poisonous Indian species occur in the area.

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[1] *Manson's Tropical Diseases*, edited by P. H. Manson-Bahr, 1921, p. 874.

[2] *The Poisonous Terrestrial Snakes of our British Indian Dominions* (including Ceylon) *etc.*, by Col. F. Wall, I.M.S., K.H.S., C.M.Z.S., 1928, p. 5.

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TABLE I.—LIST OF SNAKES FOUND IN DEOLALI

Family	Sub-Family	Species	Number examined: Mr. Fenton-Bailie's Collection		Total
Typhlopidæ ...		*Typhlops braminus* (Daud) Worm Snake	9	1	10
Boidæ ...	Pythoninæ ..	*Python molurus* (Linn.) Rock Snake... ...	2	...	2
Do.	Boinæ ...	*Eryx conicus* (Schn.) Red Earth Boa	9	1	10
Colubridæ (*Aglypha*) ...	Colubrinæ ..	*Nerodia piscator* (Schn.) Checquered Water Snake	9	2	11
Do. ...	Do. ...	*Rhabdophis stolatus* (Linn.) Buff striped Keel-back	2	2	4
Do. ..	Do. ...	*Polyodontophis subpunctatus* (Dum and Dibr.) Jerdon's Polyodont ...	1	...	1
Do. ...	Do. ...	*Macropisthodon plumbicolor* (Cantor) Green Keel-back or grass Snake	30	5	35
Do. ...	Do. ...	*Lycodon aulicus* (Linn.) Wolf Snake... ...	14	5	19
Do. ...	Do. ...	*Ptyas mucosus* (Linn.) Rat Snake	18	...	18
Do. ...	Do. ...	*Zamenis fasciolatus* (Shaw) Fasciolated Rat Snake	2	...	2
Do. ..	Do. ...	*Coluber helena* (Daud.) The Trinket Snake. ...	3	1	4
Do. ...	Do. ...	*Oligodon arnensis* (Shaw.) The banded Kukri Snake	5	4	9
Do. ...	Do. ...	*Oligodon tæniolatus* (Jerd.) Variegated Kukri Snake.	6	5	11
(*Opisthoglypha*).	Dipsadinæ ...	*Dipsadomorphus trigonatus* (Schn.) The brown tree or cat Snake.	16	6	22
Do.	Do. ...	*Dryophis mycterizans* (Linn.) The green whip Snake	...	1	1
(*Proteroglypha*).	Elapinæ ...	*Bungarus cæruleus* (Schn.) The Common Krait	5	4	9
Do. ..	Do. ...	*Naia naia*, var *cæca* (Merr.) The Cobra ...	14	2	16
Do. ...	Do. ..	*Callophis trimaculatus* (Daud.) The Slender Coral Snake ...	3	...	3
Viperidæ ...	Viperidæ ..	*Vipera russelli* (Shaw.) Russell's Viper ...	1	1	2
Do. ...	Do. ..	*Echis carinata* (Schn.) The Saw Scaled Viper...	1	5	6
	SPECIES EXTRANEOUS TO DEOLALI				
Colubridæ (*Aglypha*) ...	Colubrinæ ...	*Polyodontophis collaris* (Bengal)	1	...	1
(*Opisthoglypha*).	Dipsadinæ ...	*Dipsadomorphus beddomei* (W. Ghats, Matheran) ...	1	...	1
		Total ...	152	45	197

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Seasonal Appearance and Proportion of the Sexes.

The table on page 66 shows the numbers and species appearing during the period under survey by months. Of the number shown, 112 were dissected for the purpose of study connected with the organs, viscera, genital organs, bones, etc. The figures relative to the proportion of the sexes, as also the number of gravid females found have been included in the table.

As regards the proportion of the sexes, it will be seen in this table, compiled from notes carefully maintained throughout the period, that there is an extraordinary disparity recorded as between males and females. Thus taking the total figure of 112, the percentage for the males works out at 5·4 and the females 94·6; showing a ratio of roughly 1 male to every 17 females. It is, of course, much too early yet to form any opinion or draw any conclusion on these results, as much more data of a similar kind confirmatory of this apparent sex disproportion will be required before the position can be accepted as a true index. It would not be premature though if one were to analyse these figures by way of ascertaining the extent to which the known facts relative to the habits of these creatures fit in with the ratio of the sexes as now outlined in the table.

In an article which appeared in a previous issue of this *Journal*, Mr. Prater (April 1933)[1] reviews, on the sum total of the collected data available at present, the position connected with the association of the sexes. He quotes the many instances of partnerships between males and females limited to a period which he calls the breeding season. Owing to the insufficiency of the existing evidence this breeding season cannot be defined clearly for any one species. In certain cases the companionship was continued after actual union had taken place and was even extended till the deposition of the eggs or young. Converse proof as well is cited and emphasised, that in all the instances of the many solitary females discovered near to or upon their eggs, only in two cases, a King Cobra and a Python, was the male observed in the close vicinity.

In the survey at Deolali there was only one instance of an association, which must have temporarily existed for the purpose of sexual union, in the case of *Zamenis fasciolatus*. A gravid female was killed in a garage at about 6 p.m. on 17th January, 1935. Exactly a week later during the evening in the same garage a second snake was seen to emerge from a hole in the wall and was later killed. It proved to be a male of this species.

All the gravid females including the above-quoted specimen showed the eggs in an early state of development, having soft oval membranous envelopes containing only a creamy fluid. These pregnant females—8 in number, and belonging to various species—were recovered as will be noted at different times of the survey periods. The months in which they appeared fall into two

[1] 'The Social Life of Snakes', by S. H. Prater, M.L.C., C.M.Z.S., *Journ., Bombay Nat. Hist. Soc.*, vol. xxxvi, No. 2, p. 469 (15th April, 1933).

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TABLE II.—SEASONAL INCIDENCE AND PROPORTION OF THE SEXES

Species	January	February	March	April	May	June	July	August	September	October	November	December	Total	Sex		Gravid Female	Remarks
														Male	Female		
Typhlops braminus ...	...	...	...	...	1	5	1	...	...	1 y	...	1	9	...	...	...	y :--Very young specimens 3"-6" long.
Python molurus	1	...	...	...	...	...	...	...	...	...	...	1	2	...	...	...	
Eryx conicus	...	...	2 y	1	2	2	2 y	...	...	...	...	...	9	...	6	...	y :—Total—2.
Nerodia piscator	2 ♀	...	...	1	...	2	...	3	1	...	...	...	9	...	8	2 ♀	
Rhabdophis stolatus ...	...	...	...	...	...	1	1	...	...	...	...	...	2	...	2	...	
Polyodontophis subpunctatus. ...		1	...	...	...	...	...	...	...	...	...	...	1	...	...	...	
Macropisthodon plumbicolor.	5 ♀	2	...	2 y ♂	5 y	7 y	2 ♂	2	...	2	...	3 ♀	30	2 ♂	24	2 ♀	y :—2 in May, Total :—4.
Lycodon aulicus	2	1	...	...	2	3	2 y	2	1	...	..	1	14	...	12	...	y :—Total—1.
Ptyas mucosus	...	1	1	...	5	5 ♀	3	1	...	1	...	1	18	...	15	1 ♀	
Zamenis fasciolatus ...	2 ♀♂	...	...	...	...	...	...	...	...	...	...	...	2	1 ♂	1	1 ♀	
Coluber helena	...	...	...	...	...	2 ♀	...	...	1	...	...	...	3	...	2	1 ♀	
Oligodon arnensis ...	...	...	...	...	3	...	2	...	...	...	...	...	5	...	2	...	
O. tæniolatus	...	...	...	...	1	2 y	3 y	...	...	...	...	...	6	...	3	...	y :—Total—2.
Dipsadomorphus trigonatus...	1	...	...	...	5	3 ♂	4 ♀	...	1	1 y	...	1 ♂	16	2 ♂	12	1 ♀	y :—Total—1.
Dryophis mycterizans ...	...	1	...	...	...	...	...	...	...	...	...	...	1	...	1	...	
Bungarus cæruleus ...	1	...	...	...	...	...	1	...	1	2	...	...	5	...	3	...	
Naia tripudians	1	...	1	...	1	4 ♂	3 y	...	2	1	...	1	14	1 ♂	11	...	y :—Total—1, 7" long.
Callophis trimaculatus ...	...	1	1	...	...	...	1	...	...	...	...	...	3	...	2	...	
Vipera russelli	...	...	1	...	...	...	...	...	...	...	...	...	1	...	1	...	
Echis carinata	1	...	...	...	...	...	...	...	...	...	...	...	1	...	1	...	
Total ...	16	7	6	4	25	36	25	8	7	8	...	9	151	6	106	8	

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separate periods, December-January and June and July. Whether these two periods can be considered and defined as regular breeding seasons is very difficult to decide at the moment. The finding in two species of the young 2 to 5 months subsequent to the months during which the gravid females were encountered is consistent and would roughly indicate the interval necessary for the fertilisation, deposition and incubation of the eggs.

In the analogous examples of pairing during the breeding season amongst the Passerine birds and certain animals, one finds the sexes more or less equally distributed at least in a proportion, which would allow of the majority finding mates and forming a monogamous partnership in the sense of a seasonal continuity somewhat extended to cover sexual union, deposition of the eggs, incubation and care of the young until fledged, as is the case with many species. This form of companionship is well exemplified amongst the groups in which parental care is a paramount development and its exercise essential for the well-being and survival of the young. In the case of the snakes, however, we find an absence of parental anxiety—such indications as there are point to a scant attention paid to the eggs alone, rather than toward the young, which significantly enough emerge from the egg in a state perfectly fitted for an independent existence. Coupled with this is the evidence, that these creatures appear to lead isolated lives, in that they are normally seldom encountered in pairs. Environmental factors such as an extreme temperature in the very cold parts of the world operate in driving them into the gregarious congregations composed of the small hibernating groups in which they have sometimes been found.

The question now arises as to what are the justifications for postulating that the disproportion in the sexes supports and explains the observed habits and behaviour. A study of the detailed figures in the table shows that in certain species the number of egg-bound females recovered equals the number of the males found separately at the same time. Further, in all the species involved there is a variation in the sex proportion. The ratio in these is as under.

Species	Males	Females	Males	Females
Macropisthodon plumbicolor ...	2	24	1	12
Zamenis fasciolatus	1	1	1	1
Dipsadomorphus trigonatus ...	2	12	1	6
Naia tripudians	1	11	1	11
			4	30
		or approximately ...	1	7 or 8

This average ratio of 1:8 may probably represent in a general way the actual relative proportion existing between the sexes of the above species. Both this ratio and the equal number of males and gravid females simultaneously discovered during the two periods apparent in Table II would explain:—(1) Why they

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are not more frequently observed in pairs. (2) That the variations in their behaviour connected with the partnerships affected, which appear in some to be of a temporary nature confined to the period incidental to insemination and in others somewhat more extended until the deposition of the eggs or young, would suggest that environmental conditions (*a*) in the former, militate against a long association in areas more controlled and inhabited by man, wherein certain species find the food and other values more conducive and beneficial in the struggle for existence; (*b*) in the latter, allowing of the development of a form of parental care confined to the eggs, peculiar to the larger species like the Python and King Cobra, which occupy lone wastes and jungle tracts more free from human intrusion and interference or other detrimental factors. (3) That an excess of females would balance the scales in favour of both the propagation and survival of the species in situations where unfavourable conditions especially attributable to human enmity produce a high death rate amongst them. (4) That amongst the dominant species in any one locality the females would normally show an increasing geometrical ratio; this position would also account for the fact that they are more often seen singly.

A further study of the figures in the table shows two phases of numerical increase. The first occurring during the months of May, June and July, when the greatest numbers were recovered. May is the hottest month of the year in Deolali and the monsoon is ushered in about the first or second week in June, becoming well established thereafter and during July. The figures for these months are really a measure point or mode, which would probably also indicate the factorial values of the environment, wherein at this season the conditions are best suited to the animal, namely, (1) temperature, (2) luxuriant vegetation and tall grasses affording easy surface concealment, (3) a plentiful food supply, (4) comparatively less human interference owing to the heavy rains. Paradoxically enough the figures for these months actually feature the highest mortality incidence. A death rate in any colony of animals is considered to be selective in action with a view to the elimination of the unfits. The greatest check to increases in the snake population is the hand of man. The mortality rate here shown was practically confined to those, who most exhibited an adventurous spirit, by prematurely emerging from their hiding places, either at too early an hour in the evening, or persisted in remaining exposed and visible during the early morning and forenoon, and in a few isolated instances even during the afternoons of a cloudy day. In fact this diurnal activity of a purely nocturnal animal is mainly responsible for 90 per cent of the death rate in the total number recovered throughout the period. Sunless monsoon days and a living food supply plentifully available at this season acted as the lure drawing them unwittingly to the gamble with their lives as the stake. The adage 'Be as wise as the serpent, etc.' here appears worn into a platitude. It should reasonably read: 'Even the wise serpent has much to learn'. The second phase of numerical increase though to a much lesser and

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negligible extent occurred in December and January. Both these periods correspond with the seasons during which the gravid females were encountered. Furthermore it is singular to note that the appearance of the males synchronised with the periods, with, but a single exception, during April, in the case of *Macropisthodon plumbicolor*. This species happens to be the dominant type in Deolali.

There is therefore some reason for believing that the sex disparity noted is probably the true position, as it tends to support and explain the relations and pertinent behaviour of these reptiles.

The consideration arises in the case of snakes as to what actually constitutes a breeding season. As has been shown the data hitherto collected are very indefinite and insufficient to allow of any definable limits being assigned. The term breeding season as used in the case of birds is known to be a definite period recurring in a regular annual cycle, sometimes in certain species twice yearly. It is said to be aroused as a result of some external or rhythmic stimulus (H. Whistler, 1932).[1] If this principle be applied to the *Ophidia* then normally we would expect to find them more constantly and frequently in pairs. We have seen that the evidence on this point is very meagre. The findings at Deolali are similarly inconclusive in that only one example of an association of the sexes can be reasonably presumed to have existed—that is only one case of pairing in a total of 151 snakes. Mr. Prater (April 1933)[2] observes:—'The finding of a male snake with a gravid female does not imply that the male so discovered is the one responsible for the gravid condition of the female'. In the instance quoted above the pair belonging to the species *Zamenis fasciolatus* were the only two of this kind met with in the two years of observation at Deolali and localised to one particular spot in a garage. So that the presumption that the male was responsible for the gravid female and must have been in a direct association is fairly valid and logical. The finding on the other hand of egg-bound females without the male makes the position somewhat difficult especially in the matter of defining the limits of a breeding season. The figures for Deolali shown in the table suggest two such periods provided the recovery of unpaired egg-bound females and unpaired males belonging to the same species be the basis for such definition. When, however, the Deolali figures as to the gravid females are compared with those of Mr. Lindberg (February 1932)[3] covering a similar range of species in the Barsi Light Railway sector, a variation in the species *Macropisthodon plumbicolor* becomes evident, in that gravid females were recovered during December and January at Deolali and March, April and May in the Barsi Light Railway area. That they were absent in Deolali during the months they were met with in the

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[1] 'The Study of Indian Birds', by H. Whistler, F.Z.S., M.B.O.U., Part IX, *Journ., Bombay Nat. Hist. Soc.*, vol. xxxv, No. 3 (15th February, 1932).

[2] 'The Social Life of Snakes', by S. H. Prater, M.L.C., C.M.Z.S., *Journ., Bombay Nat. Hist. Soc.*, vol. xxxvi, No. 2, p. 473 (15th April, 1933).

[3] 'Snakes on the Barsi Light Railway (Deccan)', by K. Lindberg, *Journ., Bombay Nat. Hist. Soc.*, vol. xxxv, No. 3, p. 690 (15th February, 1932).

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other area does not preclude the possibility of such being found at some future time in the reversed positions in both localities—not only in this species, but as a common constant feature in other species as well. Nor can it be said that the seasonal variability in their appearance is attributable to the meteorological conditions varying in the different geographical settings.

The conjoint results nevertheless demonstrate well enough the small amount of evidence forthcoming despite the two years' observations in both places. This question of the breeding season and the apparent variable character of the periods amongst the different species, requires concentrated and extended observations covering many years, in as many areas as possible. The comparative excerpt relative to the recovery of gravid females both in Deolali and the Barsi Light Railway sector is as under—unfortunately Mr. Lindberg does not show the actual figures for the egg-bound females and makes no mention whatever of males. The numbers met with in Deolali have been shown with a plus sign and the numerical indicator alongside. Those of the other area by a plus sign alone.

Species	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Nerodia piscator... ...	+2	...	...	...	...	...	...	...	...	...	...	...
Macropisthodon plumbicolor	+1	...	+	+	+	...	...	...	...	...	...	+1
Ptyas mucosus	...	...	...	...	+	+1	...	...	...	...	...	...
Zamenis fasciolatus ...	+1	...	...	...	...	...	...	..	...	...	...	...
Dipsadomorphus trigonatus.		...	...	...	+	+	+ +1	...	...	...	...	...
Coluber helena	...	...	...	...	...	+1	+	...	...	...	...	...

To sum up the position we find:—

(1) Sex disparity—1 male roughly to every 8 females;

(2) Pairing infrequent—one pair in a total of 151 snakes;

(3) Solitary males and gravid females of the same species found at identical times and in almost equal numbers in the same area;

(4) Finding of young 3 to 6 in. long, two to five months subsequent to the appearance of gravid females of the same species—furnishing evidence as to the probable interval required for the fertilisation and incubation of the eggs.

Periodic Numerical Fluctuations as a result of Seasonal Changes in Different Geographical Areas.

Precise information as to the periodic appearance or absence of snakes in the various geographical areas is lamentably scanty, despite the fact that thousands of these creatures are being killed annually. Mr. Lindberg (February 1932)[1] in his contribution has

[1] 'Snakes on the Barsi Light Railway (Deccan)', by K. Lindberg, *Journ., Bombay Nat. Hist. Soc.*, vol. xxxv, No. 3, p. 690 (15th February 1932).

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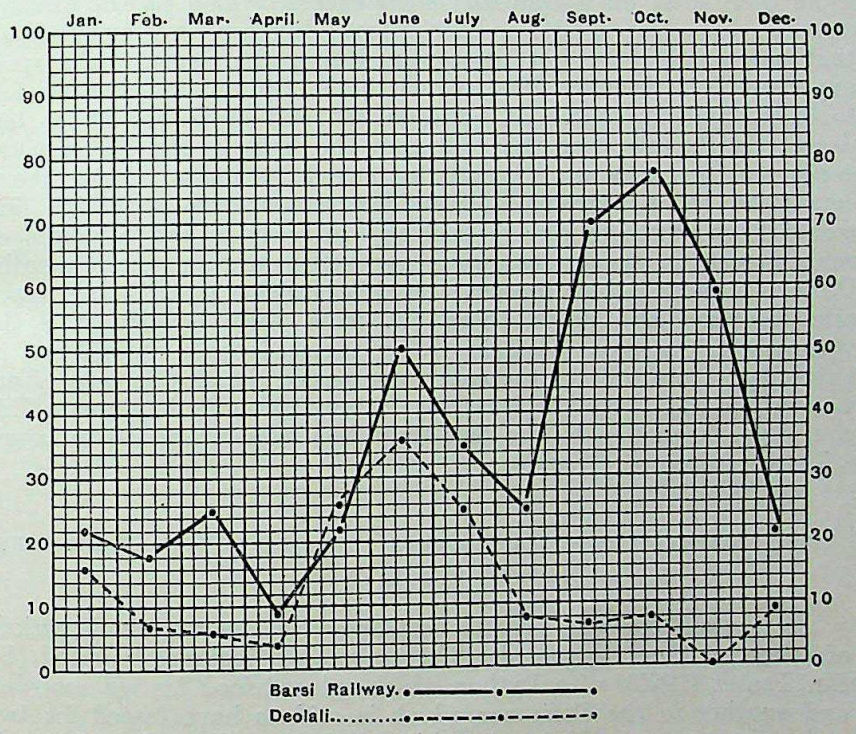
made a good beginning and the figures he furnishes for the Barsi Light Railway area allow of a comparison being made with those recorded for Deolali. This is well outlined in the graph as under, based on observations made from December 1932 to January 1935 at Deolali, and from August 19, 1929, to August 18, 1931, in the Barsi Light Railway tract, on a total of 151 and 434 snakes respectively.

Graph showing periodic numerical fluctuations as a result of seasonal changes influencing the appearance and activity of snakes in the different geographical settings of Deolali and the Barsi Light Railway Areas.



The graph shows two peaks—one in June and another, the highest, in October for the snakes on the Barsi Light Railway area. In Deolali there is only one peak during June. There is a notable absence of snakes in Deolali during November. In contrast with this the maximum numerical peak is attained during September, October and November in the Barsi Railway sector. The decline in Deolali on the one hand and the rise in Barsi on the other, during the same period suggests evidence of the effects of environment. The climatic conditions evidently at that time being unfavourable in the one and beneficial in the other locality to practically the same species.

The complete absence of snakes in Deolali during November of the two years' period of observation is significant. About the

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2nd November the cold weather is ushered in, and the change in temperature is somewhat acutely and abruptly established. It may be that the sudden drop in the temperature instinctively warns the creature and operates by keeping it temporarily confined, but not necessarily in a state of hibernation. This phase would probably represent the coincidental instinctive urge working in the expectation of a continued and increasingly severe cold setting in, like that experienced by their congeners in the very cold regions of the world, where as a result of prolonged subjection to a reduced and sustained temperature a complete torpidity or 'Winter sleep' is produced. As the minimum temperature at Deolali is at its lowest usually 44°F. and the diurnal range being great, the cold conditions here cannot induce in them, more than if at all a transient sluggishness, which passes quickly causing them to reappear in December. Further, it is noteworthy that the snakes did not disappear during the severe cold spell experienced in January 1935, when the minimum temperature fell to 31°F. and fluctuated at between 34° and 40°F. for about ten days. So rigorous was the cold that the fruit in the Nasik vineyards and orchards were greatly damaged by frost. Under these conditions of an extreme and sudden temperature reduction one would have expected not to find any increase in the numbers of snakes—yet 9 specimens were recovered during that month. Curiously enough their instincts on this occasion acted in an apposite direction and drove them out from their coverts into the warmth of the day. Certain living species which were kept in captivity at the time of the cold wave period did not go into hibernation nor was there the least sign of any torpidity in them. This may have been due to the fact that they were protected in boxes with a minimum of aeration.

Post-Mortem, Dietary and Other Findings in the Alimentary Canal.

It is a well-known fact that snakes can go for very long periods of time without a meal. There is the instance quoted by Mr. Prater (1926)[1] of a Python which refused food for ten months; and another in the Paris zoo which is said to have fasted for two and a half years. The writer himself kept and used as controls in some experiments, several living specimens of different species for eight months without food, giving them only water, without the least effect on their vitality. In the free state comparatively few are found with the alimentary canal containing evidence of an ingested meal. Of 112 specimens dissected, only 19 proved positive—approximately 17%. This suggests that the food factor does not loom very largely in their existence. Their specialised capacity for fasting tides over many long intervals of enforced starvation as during hibernation or other anxious occasions in their lifetime.

[1] *The Snakes of Bombay Island and Salsette,* by S. H. Prater, C.M.Z.S., p. 3 (1926).

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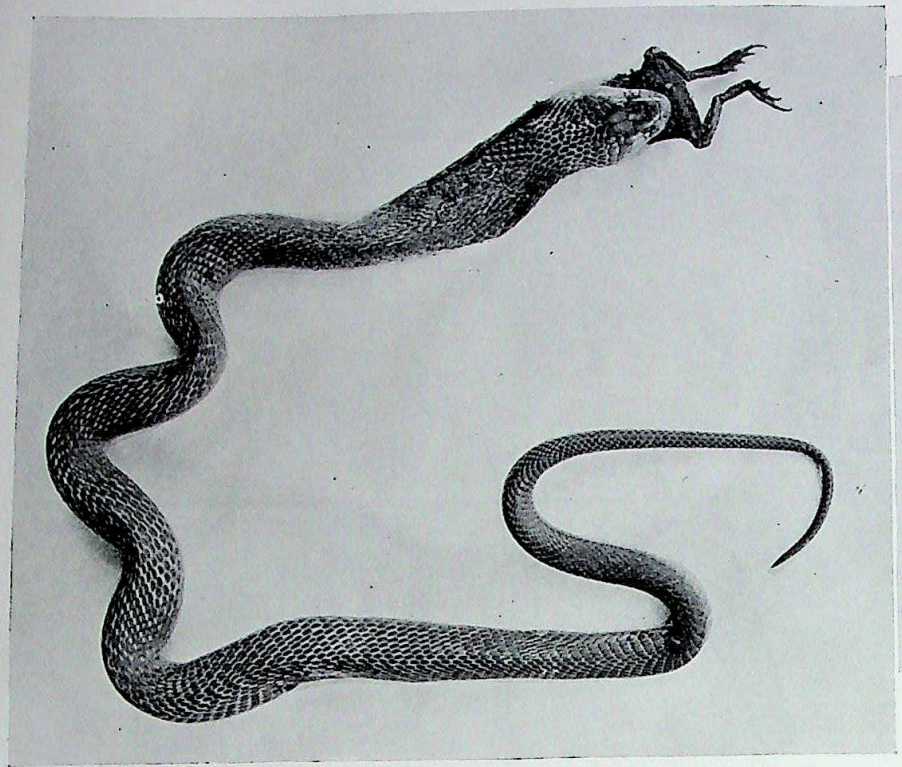

Cobra *N. naia* swallowing a frog.

Photo by *C. Diaz, Deolali.*

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The following is the dietary findings as ascertained by post-mortem investigation:—

Species	Number Positive	Remarks
Nerodia piscator	3	Fish and frogs.
Ptyas mucosus	2	Rats and in one a lizard (species unknown).
Coluber helena	1	Rats.
Naia naia var. *cæca* ...	3	Rats and frogs and in one a Pipistrel bat.
Macropisthodon plumbicolor ...	3	Frogs.
Lycodon aulicus	2	Lizard (*Gecko*) and scorpion (*Buthus sp.*).
Dipsadomorphus trigonatus ...	3	Lizard (*Calotes versicolor*).
Eryx conicus	2	Palm squirrel.
Echis carinata	2	Earthy matter and rootlets.
Bungarus cæruleus ...	1	Earthy matter.
Typhlops braminus ...	1	,, ,,

A specimen of *Nerodia piscator* furnished an example of voracious feeding. The post-mortem revealed nine frogs and seven fish of varying sizes. The largest fish measured 3½ inches. Those which had reached the small intestine were partially digested. From below the throat backwards the alimentary canal was loaded with the fare. Unfortunately the photograph taken of the dissected snake with its victims laid alongside proved to be overexposed.

In one *Ptyas mucosus* a lizard was found—a striped variety, which is frequently here seen in the open country. The zoological classification of this lizard is not known to the author. The specimen has been sent to the Bombay Natural History Society for identification.

A Pipistrel bat was discovered in a cobra. This is a very unusual find and is particularly intriguing in view of the fact that the snake had been killed at 9-30 a.m. on the ground surface in the compound enclosure of a bungalow. One can, of course, only conjecture as to the how, when, and where of the circumstances, which caused the pipistrel to become a victim. It would be a reasonable surmise to say that the snake had secured the bat during daylight in the roof of the house, and cobras have sometimes been found in such situations; but on dissection the pipistrel was found in the alimentary canal in a position corresponding to the region of the hood. This fact would indicate that it had probably been swallowed some two or three hours previously. In the writer's experience, observations maintained in order to ascertain the time required for the complete digestion of frogs and lizards in the green keel-back (*Macropisthodon plumbicolor*) and the common cat-snake (*Dipsadomorphus trigonatus*) showed, that digestion is completed with no trace of even the victim's bones in approximately 72 hours. So that on this basis of calculation the pipistrel must have been seized in the early hours of the morning, either on its return to the roost in the eaves of the building, or at the ground level under

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conditions of a handicap, which is very obscure and a futile speculation. Whatever the facts may have been it is nonetheless interesting to record this unique diet item in the menu fare of a cobra.

It may interest the reader to know how the time factor of 72 hours, estimated as required for a snake to completely digest a bolus, was arrived at. This was due to the accidental discovery, that red silk cord or thread is not subject to the action of the digestive juices secreted in the alimentary canal of the snake. It passes through quite unaffected. It came about in this way. For want of something better an attendant used a thin red silk cord slip knotted at one end to ensnare a medium-sized lizard (*Calotes versicolor*). Having secured it, he placed the lizard in a box containing a live *Dipsadomorphus trigonatus*. In doing this he cut the thread a short length from the slip knotted end which encircled the neck and dropped the lizard into the box. Some days later after the snake had feasted and digested the meal, the red silk cord was noticed lying in the box. The snake had obviously ejected it *via* the vent. The fortuitous omission to remove the red cord from the lizard in the first instance, led to many experiments being carried out in which the cord was used—not necessarily red, but the colour was convenient—tied to the legs of frogs and lizards and time records maintained from the moment they were swallowed until the cord had passed through the cloaca. This period in all cases worked out at 72 hours for the cord, but digestion must have been effected in a little under this timing.

Macropisthodon plumbicolor was found to feed solely on frogs, which appear in great numbers during the monsoon months. One of these snakes displayed in the matter of food a selective sense which is of interest. A male toad (*Bufo melanostictus*) was placed along with an adult specimen of this species. The toad appeared to realise the presence of the snake; as it showed during the first day very definite signs of fear. When at sundown the snake began to actively move about in the box, the toad exhibited great agitation and persisted in jumping at the intervening glass panel between it and freedom. If the snake approached too near, it quickly hopped away to a safe distance. On the second day the toad showed some composure, but behaved as on the first day if the snake at any time came near. On the third day surprisingly enough it evinced no dread whatever and was seen during the day calmly perched upon the coiled snake. On the night of that day the snake's activities did not in the least disturb its equanimity and it even allowed the snake to approach and pass it without leaping away. On the fourth day the toad showed signs of desiccation and did not appear too well and as the snake had shown no desire to swallow it, the toad was removed and placed in water. On the night of the fourth day a frog was secured and put in the box and significantly enough the snake at once seized it at the side of the neck and raising it clear off the floor held the frog firmly, while it squawked in terror—not all frogs make this sound, the majority are silent and stupidly inert when being swallowed. The snake maintained its hold for 12 minutes until the frog ceased

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to struggle and while it was still alive and without having recourse to using the floor of the box, the snake veered the frog around by a gulping action until the head entered its mouth, when it began to swallow by alternating movements of the jaws. It then rubbed its neck by vigorous pushing movements along the floor of the box until the bolus had passed the cervical region. Plate I shows a cobra (*N. naia*) in the act of swallowing a frog.

A common Wolf Snake (*Lycodon aulicus*) was killed in the act of swallowing a scorpion. As the back of the snake had been broken it had ejected the scorpion when in its death throes. This information was given when the snake and the scorpion were separately brought. On examining the scorpion it was noticed that the maxillary palps, the chelicerae and the telson were missing. Dissection of the snake proved the alimentary canal to be empty. Further inquiry elicited no clue as to the missing parts of the scorpion, and an assurance was given that it had been brought as found. The snake when first observed was on the verandah of an Indian dwelling. How the parts of the scorpion came to be missing must remain a mystery.

In the writer's garden one night at 11 p.m. an interesting incident was brought into view by the flash of an electric torch which revealed but did not disturb either the snake—an adult *Dipsadomorphus trigonatus*, or the lizard—a small-sized *Calotes versicolor*. The lizard could not have been aware of the snake's approach. At the moment the light was flashed in their direction, the lizard was seen perched at the foot of a shrub and the snake was actually in the act of seizing its victim by a darting movement. It did so at the side of the lizard's neck and thereupon a desperate struggle ensued. Both snake and lizard rolled over on the ground; the lizard making frantic endeavours at escape and even dragging the snake along for a short distance. The snake then coiled itself around the lizard's body and prevented it from further progression and struggling. Presently a lull in the proceedings occurred, as the lizard now showed signs of exhaustion. It was breathing very heavily, but nevertheless still made futile and weakened efforts to free itself. After 16 minutes had elapsed the lizard commenced to sag and showed the onset of a moribund phase, depicted by a drooping of the head and closure of the eyelids. A further three minutes ushered in convulsions. The snake at this juncture released for the first time both its mouth and body hold and moved to the lizard's front. It then once more seized the head and while the lizard was still alive and breathing it commenced to swallow. This it did with a series of gulping movements, often seen in the farmyard when a chicken attempts to swallow too big a bolus of food—the forward and upward throwing of the head and short jerk back motion with distended jaws, tossing the lizard in the air to assist the effort. The jaws of the snake then moved alternately and independently to enable the teeth exerting a traction force backwards on the head and body with each fresh alignment taken. It occasionally rubbed the lower parts of the jaw and neck along the ground by way of aiding deglutition. When it had half swallowed the lizard the

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snake was lifted up without signs of resentment and put into a box. The species of lizard mentioned above has been a constant find in the gut of this snake. Other observers have found chickens and eggs in this species.

In *Eryx conicus* the grey-striped squirrel (tree rat) was found. Mr. Lindberg (1932)[1] also mentions an instance of one of these snakes observed in the act of capturing a squirrel.

A point of interest noted in all the snakes, whether alive or dissected, was the outstanding fact that they swallow mammal, lizard, frog or fish, head first. This is an instinctive habit which mechanically facilitates the downward passage of the dead body which is ingested with the legs posteriorly deflected and folded in underneath. Muscular contractions of the ribs further aid lateral compression and propulsion backwards of the bolus. Were this not the case the dead lizard's spined dorsum and the clawed feet of frogs and mammals would be caught up and become impacted causing an obstruction in the alimentary canal.

In two specimens of *Echis carinata* the large intestines were astonishingly enough loaded with caked earthy matter in a half dry state and admixed with filamentous lengths of rootlets. Plate II depicts one of these snakes with its loaded bowel contents throwing the dark shadows of this substance. It is regretted that a sample was not retained for chemical analysis. X-Ray pictures of *Bungarus caeruleus* (Krait) and *Typhlops braminus* also show to a lesser extent earthy matter in the alimentary canal, both of which were confirmed by dissection. All of these snakes were free from any helminth infestation. This point is mentioned because in another snake, *Nerodia piscator*, the gut was crammed with a green and rather stiff water weed, which had become entangled with a mass of worms (nematodes), a few of which were alive and clinging to the stomach wall. Here the suggestion is strong that the weed had been swallowed on purpose as a curative measure in order to both dislodge the worms and kill them. The vermifugal and vermicidal action was certainly evident, because the majority of the worms were dead, judged by the discolouration of their bodies in contrast with the few living worms which were pinkish white and exhibiting movement. It was owing to these few still living forms being imbedded and attached to the stomach wall that the mass was held up in its backward motion in and through the alimentary canal.

The question of interest arising in the finding of earthy matter in the bowel of the snake is, whether earth-swallowing is also a habit with the snakes akin to that generally observed amongst other animals (salt licks)? The writer is unaware of a similar instance having been previously reported by other workers. Since the percentage works out at roughly 2 per 100 of the killed numbers in this survey, there is reason to believe that it is at times necessary for them to swallow earth in order to fulfil a physiological purpose.

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[1] 'Snakes on the Barsi Light Railway (Deccan)', by K. Lindberg, *Journ. Bombay Nat. Hist. Soc.*, vol. xxxv, No. 3, p. 690.

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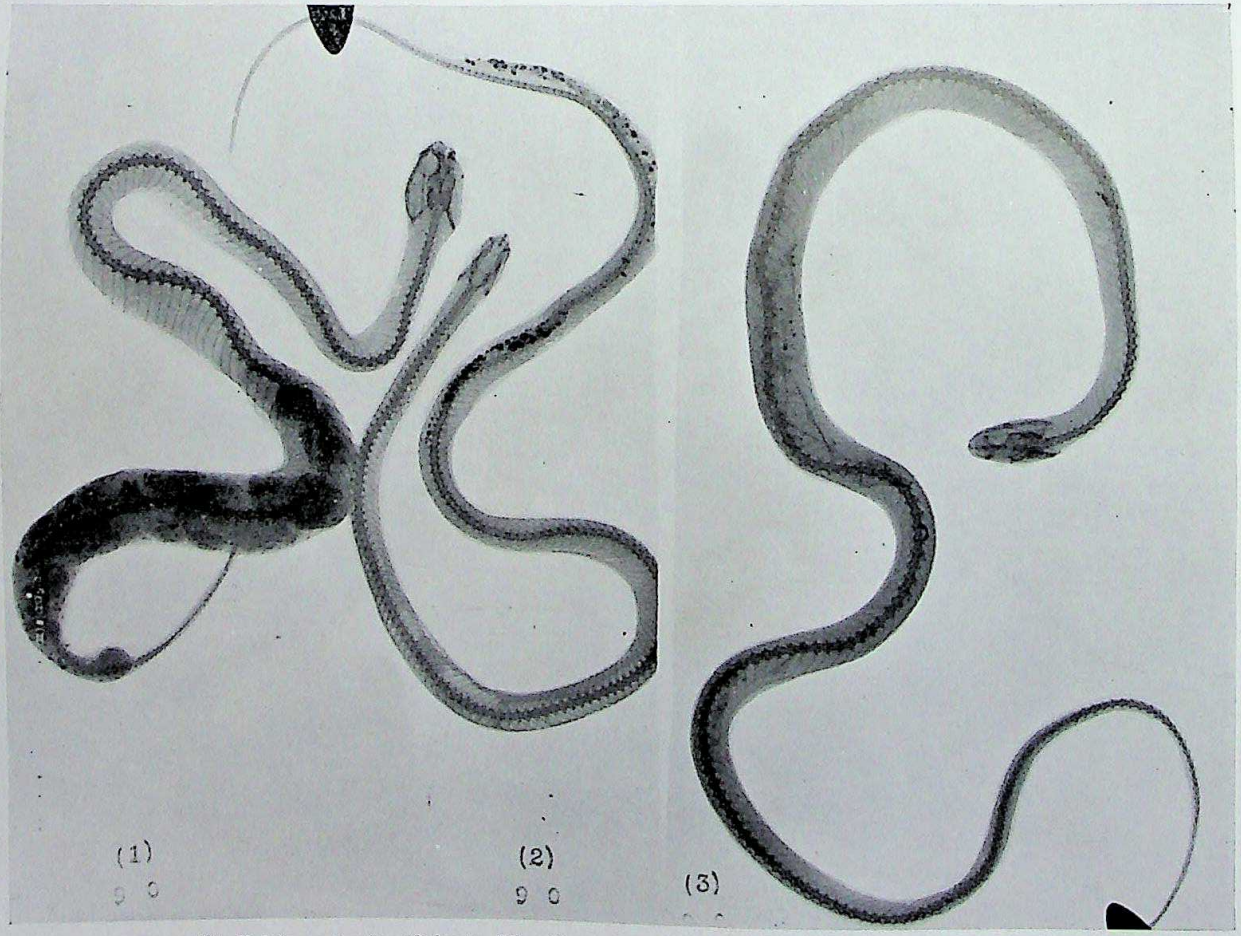

(1) *Echis carinata* (Schn.), The Saw Scaled Viper. Showing the lower bowels loaded with earthy matter.
(2) *Bungarus caeruleus* (Schn.), The Common Krait. Showing earthy matter in the lower bowels.
(3) *Rhabdophis stolatus* (Linn.), The Buff-striped Keelback. Showing the remains of an ingested meal—the bony outline of a lizard (?).

Radiograph by *C. P. Coshan, I.M.D.*

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Cannibalism amongst snakes is a feature, which has been occasionally recorded. There were no examples of it noted at Deolali. The habit is evidently atavistic and confined to only a few.

About 12 per cent of the snakes dissected were infected with nematodes. It appears to be a disability in a general way common to most of the species. It must act as a considerable handicap, serving as a check to increase in their population. Those suffering from worms reject food. Several died early in one to two months of captivity. Post-mortem investigation revealed heavy infestations with worms in bunched masses occupying the stomach section of the alimentary canal.

Exfoliation.

The snake as is well known periodically throws off the epidermic investment. In order to ascertain the extent to which this is done and the manner in which it is brought about, a certain number of snakes were kept under observation for eight months. These were made into two series. One set from which the food was withheld, acted as controls for the other fed with such frogs, tadpoles and lizards as were procurable. All were watched and inspected as time and opportunity offered throughout the period. Receptacles containing water were kept replenished in their boxes, but were put in only from 18th April onwards. The number of times each snake in the respective series desquamated is shown as under:—

Species	Series No. 1 (fed).									Series No. 2 (Fasting control).								
	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Moults	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Moults.
Macropisthodon plumbicolor ...	.	...	...	1	1	2	1	...	5	1	...	...	...	...	1	...	...	2
Macropisthodon (young) ...	...	1	...	2	1	2	2	1	9	...	...	1	...	...	...	...	...	1
Nerodia piscator (young) ...	1	...	1	1	2	1	2	2	10	No control available.								
Lycodon aulicus.	...	...	1	...	1	...	...	...	2	..	1	...	...	...	...	...	...	1
Dipsadomorphus trigonatus ...	1	...	...	1	...	1	...	1	4	...	...	...	1	...	...	...	...	1
Oligodon tæniolatus ...	..	...	1	...	...	..	...	...	1	...	...	...	...	..	1	...	...	1

Desquamation occurred most often at night and was as a rule a complete cast. There are preliminary phases. For a day or two a change to a darker colour shade is noticeable. The outer layer of the epiderm is then seen to be slightly raised and wrinkled between each scale division. This roughening presents the appearance of a powdered surface owing to the whitening of the older exoskeleton.

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The latter then loosens and lifts throughout the body length and as the caudal section is freed, the snake by opening its mouth widely several times releases the investments on the dorsal and ventral aspects of the head and by free movements over the ground surface crawls out of the detached cast. In some cases the epiderm becomes adherent in parts especially on the head. In such examples there is a general splitting of the covering, which then peels off in the course of a few days. During this time the snake is temporarily blinded unless the old antocular membrane becomes detached and is shed. Some snakes when afflicted in this way immerse themselves in water and get rid of the old skin.

The greater number of desquamations occurred amongst the fed series; apparently this must be a measure of the growth occurring as a result of the feeding. The control series probably reflect more truly the actuals taking place in the free state.

The following impressions were gained. The young specimens exhibited much greediness and fed voraciously, not as a regular daily feature, but at irregular intervals. The young water snake showed a perference for tadpoles and when these were available eschewed the frogs. It remained immersed in the water for most of the time. The adult specimens also fed irregularly and displayed the greatest activity at night; and when not feeding moved restlessly about looking for a means of egress. *Lycodon aulicus* fed sparingly, and it is doubtful whether *Oligodon taeniolatus* fed at all.

The Snake's Basking Habit considered in relation with Sun Traumatism produced in them as a result of direct exposure to the Sun's Rays.

The snake's basking habit has been frequently observed and recorded, more often as a marked feature peculiar to the vipers, and fresh water species. Whether it is general and indulged in by all snakes is not clear. The writer while on fishing excursions during the cold months of the year has often seen *Nerodia piscator* lying upon the river's bank exposed to the direct rays of an afternoon sun. As these snakes invariably returned to the water on one's approach it was found impracticable to time the period they remained so exposed. Snakes being poikilothermic or cold-blooded any prolonged exposure to the sun's rays must act adversely by disturbances set up in the metabolic balance and heat regulating centre, producing a sun traumatism resulting in death. As a matter of ecological interest, therefore, experiments were carried out by placing these creatures in the sunlight and estimating the time required for bringing about hyperpyrexia and death. For this purpose a bare patch of ground was selected free from any holes, away from trees and thus devoid of any shade. The snakes were allowed one at a time to roam freely over this area, but prevented from leaving it. It is greatly regretted that no solar radiation thermometer was available for those experiments; though the ordinary shade temperature readings have been

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recorded. The results of these experiments are set out in the table as under.

Species	Date of Experiment	Temperature		Time of Day	Sun trauma produced in minutes	Death in minutes	Remarks
		Maximum in the shade	Minimum in the shade				
Dipsadomorphus trigonatus ...	14- 5-1934	92	76	10 a.m.	25	28	clear sky.
Do. ...	14- 5-1934	103	76	2 p.m.	4	6	,,
Do. ...	20- 9-1934	86	68	11 a.m.	50	57	,, and some clouds.
Do. ...	18- 1-1935	76	36	10 ,,	83	85	cold and frosty.
Lycodon aulicus.	14- 5-1934	92	76	10-35 ,,	4	5½	clear sky.
Do. ...	20- 9-1934	86	68	12 noon	10	12	cloud and sun.
Do. ...	3-12-1934	82	45	3 p.m.	12	14	clear sky.
Cobra ...	14- 5-1934	103	76	2-30 ,,	6	8	,,
Do. ...	20- 9-1934	86	68	2 ,,	58	62	cloud and sun.
Do. ...	12-12-1934	82	48	3 ,,	66	68	clear sky.
Do. ...	16- 1-1935	80	33	2 ,,	70	74	,,
Eryx conicus ...	14- 5-1934	93	76	11 a.m.	4	5	,,
Macropisthodon plumbicolor ...	14- 5-1934	96	76	11-30 ,,	15	18	,,
Do. ...	14- 5-1934	103	76	3 p.m.	2	3	,,
Do. ...	29- 6-1934	79	70	10 a.m.	32	35	cloud and sun.
Do. ...	3-12-1934	82	45	2 p.m.	25	27	clear sky.

The foregoing experiments show that certain species manifest a greater tolerance, as evidenced by the Cobra, over others, like *Lycodon aulicus*, are more susceptible and quickly overcome by the heating of the body. No vipers were forthcoming for comparison in these experiments. All the snakes used behaved exactly alike and showed a similar train of symptoms. They manifested an active restlessness, working the tongue ceaselessly the whole time. Every effort was made to regain the cool shade of the trees and, remarkably enough, in doing this they evinced a sense of direction, by moving toward an avenue of trees which flanked the bare patch within which they were compelled to remain. Even when their heads were directed in the opposite direction—away from the avenue—they turned about and unfailingly moved towards it. Some of them willingly and eagerly followed one in order to reach the shadow cast by one's body. This state of activity continued until the heat engendered within the body, as a result of the muscular output combined with the heat rays from the sun and presumably also excess formation of lactic acid in the tissues, caused hyperpyrexia. This was evidenced by inertia (slowing of the movements), loss of incoordination (swaying of the head and rolling over of the body on to the back in the efforts at progression). Coma was then ushered in by complete cessation of locomotion—widely distended jaws and laboured breathing—which finally ended in death. In the male the generative organs prolapsed.

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The Cobras, in the early stages, remained stationary and alert with erected heads and expanded hoods in a state of defensive aggression, until the heat from the sun's rays compelled them to a realisation of the discomforts in the situation and soon reduced them from the sublimity of a venomous intimidation to one of ridiculous and abject submission.

It is clear that the habit of basking must necessarily be restricted to the time period required for regulating the body temperature to the optimum conducive to comfort and well being, as after emergence from hibernation, or as in the case of the aquatic types after prolonged immersion in water during the cold weather. Col. Fayrer (1872)[1] referring to the vipers, remarks that the temperature of the gravid female increases during gestation and that a higher body temperature than that which is natural to the viper in its ordinary condition is necessary to effect the incubation of the eggs. The gravid female is said to then expose herself to the heat by basking in the sun's rays. Most of the past recorded evidence involves mostly the vipers. Such information as there is sadly lacks in the essential details as to the time and day of the year, the sex and other relevant particulars.

During the cold wave period of January 1935, the Military Dairy Farm Manager, Deolali, shot with a single round (No. 4 buck shot) two gravid *Nerodia piscator*, which were basking together at the same spot on the river bank at 9-30 a.m. on 9th January 1935. The author's experience is limited to a single Russell's Viper, which was secured during March 1927, at about 10 a.m. when sun bathing in the precincts of the Pasteur Institute, Kasauli (Simla Hills). Mr. Strover[2] reports the finding of an *Echis carinata* at 3 p.m. on 8th January 1933 in the environs of Peshawar. Mr. Prater (1926)[3] also found the same species on two different occasions at Santa Cruz and Andheri. He remarks that the corrugated zinc forming the roof of a hen coop upon which the viper basked was hot to the touch and at a time during the afternoon.

Locomotion.

This reaches its highest attainment—so far as the Deolali snakes are concerned—in *Ptyas mucosus* and appears to be a specialisation confined to that species showing a well developed musculature, nearly uniform body thickness proportionate with great length. As regards *Ptyas mucosus*, personal observations go to show that the speed is equal to that of the average running pace of a man. This rate, apparently, cannot be maintained for any great distance, particularly by the full grown older specimens over 8 ft. in length. In this snake locomotion takes the form of an almost straight course in the direct axis of the body with

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[1] *The Thanatophidia of India*, by Col. F. Fayrer (1872).

[2] The Saw-Scaled Viper (*Echis carinata*) about in Winter, by C. H. Strover, B.A., *Journ., Bombay Nat. Hist. Soc.*, vol. xxxvi, No. 3 (15th August, 1933).

[3] *Snakes of Bombay Island and Salsette*, by S. H. Prater, C.M.Z.S. (1926).

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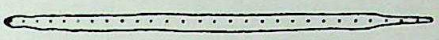
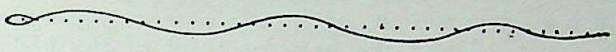
a slight wavy side to side swing. In *Python molurus* the movement is practically straight and slow, because of the excessive thickness and weight. There are gradations from this standard in which the zigzag motion is but slightly more exaggerated, or greatly emphasised. The following line drawings depict the various forms of locomotion observed.

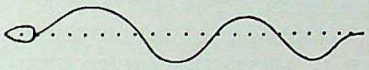
Python molurus



Ptyas mucosus



Vipera russelli



Lycodon aulicus

On an average, locomotion is poorly developed, unwieldy, and the rate of progression slow. If excited, the smaller snakes work their bodies so vigorously, that the spiral curves in the side to side motion become greatly increased and progression is retarded. If not directly operating as a handicap in the quest for food, it is clear that even the maximum speed often fails in helping snakes during daylight to escape from their greatest enemy—man—and unless there are holes in the ground, or thickly grown vegetation near to them, their chances for getting away are reduced to a minimum. The inherent fear of snakes entertained by mankind in general is a much more valuable factor in making escape possible for them. Hence it is that only the larger species have developed speed as a speciality, possibly because their habits are partly diurnal. As regards the search for food, speed is not an essential requirement. It is chiefly during the nocturnal perambulations, that they meet with a great measure of success, the victims being either somnolent or else suddenly taken unawares.

The *modus operandi* in locomotion is brought about by the combination of muscular action on the ribs causing them to execute a sweeping laterally depressed motion by which the abdominal scutae obtain a purchase on the ground surface and propel the body forward in movement. The intercostal muscles are contracted by sectional waves passing from the neck backwards—this is well seen in *Python molurus*, in which each contraction wave involves approximately eight pairs of ribs. Each section is independent in action, the ribs in it working together. The waves of contractions following rapidly in succession present a rhythmic uniformity in the movement of the ribs, which can be distinctly seen in sectional motion under the epidermis. The longissimus dorsi and semi-spinalis dorsi muscles direct torsion and lateral

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flexions of the body (vertebral column), which are controlled by the articulations of the vertebrae to be described later.

Note on the Peculiar Use made of the Tongue by Snakes and Some Lizards.

A striking feature in the behaviour of a snake is the peculiar use it makes of its tongue. The cause of this seemingly purposive act is not generally understood. A like action of the tongue is observed in some species of lizards (the monitors), whose tongues are similarly bifid and protractile. The habit as noticed amongst the *Ophidia* synchronises with the exercise of muscular activity, such as locomotion, or in the case of the Cobra, when the hood is expanded and the anterior third of the body is erected. It is only in these active states that these creatures shoot out the forked tongue in quick succession. The act appears to be in the nature of a physiological expression of some function serving to their benefit. The author is unaware of any scientific explanation for this characteristic behaviour. Any theoretical considerations offered in elucidation of the act must necessarily be advanced on some physiological ground. In the experiments outlined in this paper relative to the effects of exposure to the direct sun's rays, the observation with regard to the constant use of the tongue made by the snake led to the consideration that this organ in view of its bifid construction may not altogether be a sensory one. The suggestion is strong that it may also serve a second important function by helping considerably in the maintenance of the thermal balance, in preserving it at the level necessary for the well-being of the organism. Snakes being cold-blooded, their temperature varies with the surrounding medium and is normally a degree or two above it. Any muscular output is always attended by heat production in the tissues and there must be some means for eliminating the heat engendered, especially in an animal which is totally unprovided with sweat glands. In view, therefore, of the fact that the act is a spontaneous one and associated with muscular activity alone, there are tenable reasons for believing that the heat formed in the tissues is got rid off by evaporation of the moisture from the extruded surface of the tongue. Analogous examples of the kind are seen in homoiothermal animals (warm-blooded) whose skins are in part devoid of sweat glands, as in the familiar instance of the overheated and panting dog. Again on very hot days, birds open their beaks and extrude the tongue for a similar purpose.

Conversely, in very cold weather the temperature of the snake is considerably lowered and body metabolism reduced, as a result there is less heat formation. A prolonged reduction in the temperature of the external air causes the snake to go into hibernation.

(*To be continued*).

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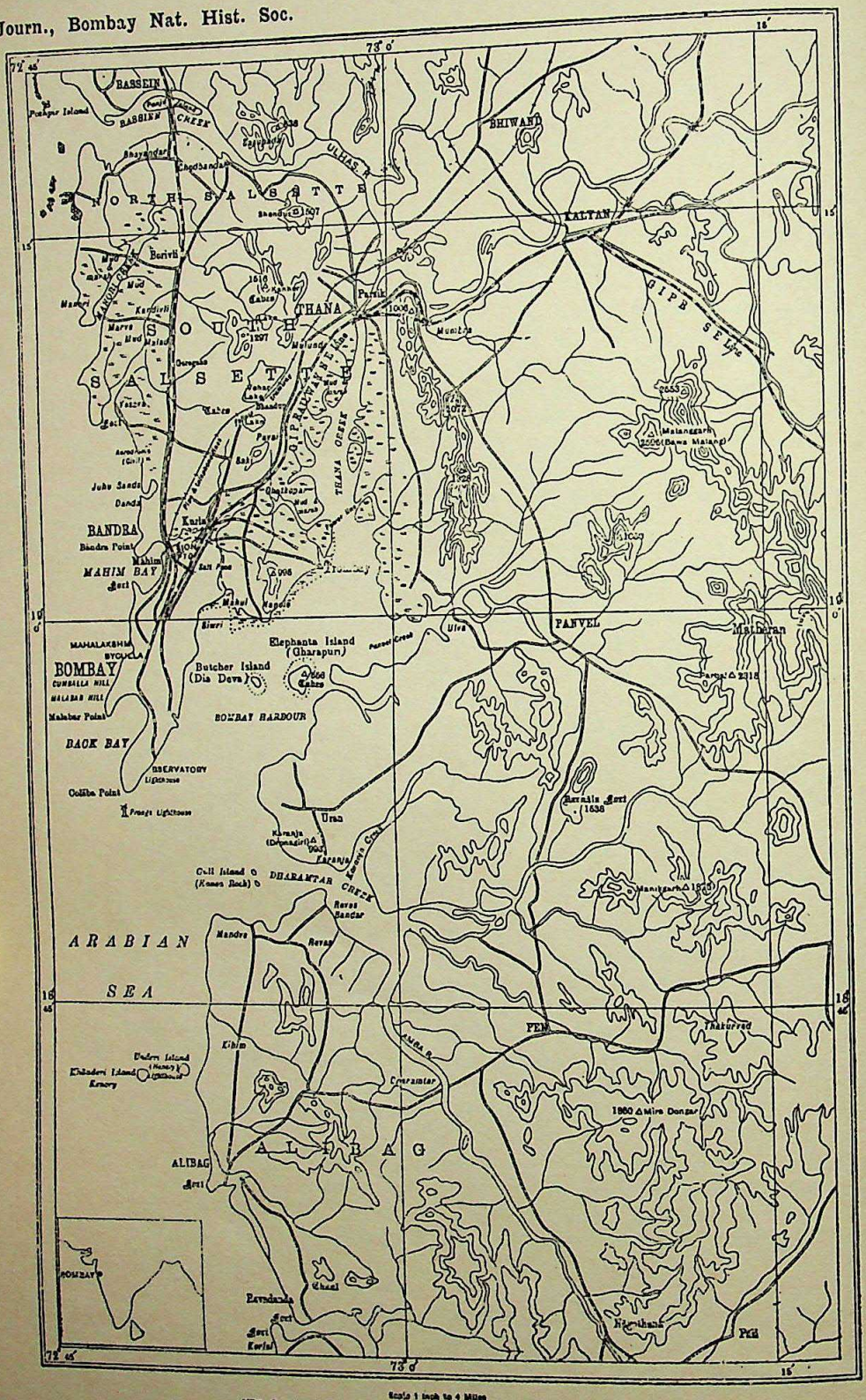

THE ISLANDS OF BOMBAY AND SALSETTE WITH THE ADJOINING MAINLAND.

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THE BIRDS OF BOMBAY AND SALSETTE.

BY

SÁLIM ALI and HUMAYUN ABDULALI.

PART I.

(With a map and four plates).

INTRODUCTION.

(a) *General.*

This paper is the second of the series on the fauna of Bombay and Salsette.[1] It is the result of many years of casual observation supplemented by more systematically kept notes and records by one of us (S. A.) between 1924 and 1929, and by the other (H. A.) mostly from 1931 onwards. The few specimens that were collected by Sálim Ali were mainly for the confirmation of subspecific attributions. A fuller and more representative collection has since been made by Humayun Abdulali for his college museum (St. Xavier's). He was particularly successful in his nesting activities, a fact which has made possible somewhat greater completeness in our accounts. We have also taken advantage of the notes made by Mr. Prater during his residence in the suburbs at Andheri between 1923 and 1924. All previously published records relating to our area and its vicinity have been collated as far as possible. Where a likely species has not actually been known to occur or breed within our limits, the nearest record we can trace on the adjoining mainland has been cited, as there seems to us no sufficient biological reason why most of such species should not at some time or other also be found on the islands.

Nothing like exhaustiveness is claimed for the paper. It is merely offered in the nature of a working list and as a framework on which other observers can build. Later on it is intended to be issued as a Prince of Wales' Museum publication in booklet form and as a companion to *The Snakes of Bombay Island and Salsette*. In order, therefore, to make it a more useful guide to the public we have, at the suggestion of the editors, given at the head of each species a rough general description as an aid to field identification. Where the scientific names differ considerably, those by which species are referred to in EHA's *Common Birds of Bombay* are also given for the reader's convenience.

All the skins, including some old ones from the collection of the Bombay Natural History Society, have been examined, and

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[1] The first, on the Snakes of Bombay and Salsette by S. H. Prater, appeared in vol. xxx, pp. 151-76.

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racially determined for us by Mr. Hugh Whistler to whom we wish to express our thanks.

(b) *Historical.*

The town and island of Bombay have undergone stupendous transformation since the days when E. H. Aitken (EHA) wrote in the *Times of India* the inimitable chapters that now comprise his almost classic *Common Birds of Bombay*, and since E. C. Comber compiled his bird list for the Bombay Government Gazetteer. The evolution has been particularly aggressive since the beginning of the present century. Salt marshes and mud flats where in the eighties and nineties the old redoubtables like Aitken and Inverarity hunted curlew, snipe and golden plover, have since been filled and reclaimed and either intensively built upon as at Tārdeo, or altered out of all recognition into delightfully green and well kept playing fields as of the Willingdon Sports Club or the Race Course at Mahāluxmi, justly acclaimed as one of the finest in the East. Worli and Māhim which until quite recently were one vast stretch of dense, gloomy cocoanut groves have now been cleared and built upon or opened up into spacious promenades, playgrounds or wide arterial thoroughfares. The low line of hills flanking the sea at Worli has been levelled for the most part, and extensive development and colonising activity has also taken place at Sewri and in the outlying areas around it. Tanks such as the Gowālia, Bābūlla and Dhobi Talāo have been filled as part of the widespread anti-malarial campaign, thereby driving out the few remaining dabchicks from their last defences.

Where but a few years since the call of curlews, oyster-catchers and sandpipers resounded at low tide through the stillness of night, the hooting of motor horns and the incessant din of scurrying traffic now proclaim Ballard Estate as one of the city's liveliest business centres.

The years immediately following the cessation of the Great War witnessed a particularly feverish spurt of urbanising activity. The short lived boom in trade and industry and the unprecedented influx of population into the city from the outlying districts brought about housing congestion and a soaring of land prices that necessitated expansion into the adjoining island of Salsette. Schemes, both public and private, for the development of areas that had hitherto lain marsh or jungle were ardently undertaken, and even the sea was not immune. An extensive area of Back Bay reaching from Colaba to Chowpatty has been reclaimed. Dānda, Khār, Pāli Hill, Borivli, Chembūr and many other areas hitherto unhealthy low-lying tracts or scrub jungle were reclaimed and developed, and with the simultaneous opening up of good motor roads and fast electric local train services, they sprang up with amazing rapidity into popular and populous residential suburbs.

(c) *Topographical.*

The composite island of Bombay on which the city is situated (originally consisting of seven small islets) is one of a group lying

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off the Konkan Coast 18° 55′N × 72° 54′E. By the construction of causeways and breakwaters in comparatively recent years it is now permanently united on the north end with the larger island of Salsette and so continuously with the mainland. The remainder of the group of islands—Elephanta or Ghārāpūri, Butcher or Dia Deva, Gull Island, Kānsa Rock and others, together with the two further south viz. Underi and Khanderi—constitute a part of the administrative district of Kolaba, but are near enough Bombay to be included in this paper, as is also the case with the mainland immediately opposite them.

The island of Bombay is trapezoid in shape and consists of a low-lying plain about 11½ miles long by 3 to 4 miles broad, flanked by two parallel ridges of low hills. Colaba Point, the headland formed by the longer of these ridges, protects the harbour lying to its eastern side from the force of the open sea; the other ridge terminates in Malabar Hill and between the two lies the shallow expanse of Back Bay. Before the construction of the embankment known as Hornby Vellard the central plain was liable to be submerged at high tide. To the north and east recent schemes of reclamation have similarly shut out the sea and partly redeemed the foreshore for the use of commerce. The coast is low, the highest point—Malabar Hill—being about 180 ft. above the sea. In the extreme north of the island (near Sion and Kolvāda) a large tract of salt-marsh still remains partly unreclaimed. At the southernmost point a dangerous reef—the Prongs—juts out from Colaba Point and on it stands the lighthouse known by that name.

Salsette, with which the northern end of Bombay is connected by means of the Sion and Māhim causeways, is a larger island extending northwards from Bandra for about 16 miles, right up to the Bassein Creek. It is rich in rice-fields diversified by jungle and studded with hills, and has an area of 246 sq. miles. Along its centre, from north to south, runs a broad range of hills which after subsiding into the plain near Kūrla crops up again in the southernmost part of the island of Trombay. The central and highest point—Thāna or Kanhēri Peak (1,516 ft.)—stands a little to the north of Tūlsi Lake, and there is another detached sharp peak—Shendūr (1,507 ft.)—still farther north. Spurs from the main range run west towards the sea, while the low lands are much intersected by tidal creeks which, especially in the north-west (Bhāyandar, Manōri, Malād etc.), split the sea face of the taluka into small islands. The staple crop is rice and most of the uplands are reserved for grass for the Bombay market. The coast abounds in cocoanut groves while the palmyra palm grows plentifully in most parts of the island.

(*d*) *Meteorological.*

The rainfall in Bombay, restricted to the South-West Monsoon (June to September), averages about 75 in. annually. In the better wooded parts of Salsette it is slightly higher. The mean average temperature is 79°F. The climate is equable but humid,

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The hottest months of the year are May and October, i.e. those which immediately precede and follow the rainy season.

(e) *Vegetational.*

The vegetation does not differ from that of the parallel terrain on the adjacent mainland. Along the coast, flanking the numerous tidal creeks, salt marshes abound with mangrove belts of varying extent, principally *Avicennia* and *Bruguiera*. On the land just above this zone, not under daily tidal influence but inundated at spring tides, the Sea Holly (*Acanthus ilicifolius*) usually thrives. The extensive mud flats on the west of Salsette are studded with small 'islands' that support a sparse growth of grass, Babul, *Salvadora persica*, *Clerodendron inerme* and other xerophytes. They often harbour a small avifauna of their own. If carefully controlled, they provide excellent opportunities for the study of migration as their smallness enables arrivals and departures to be noted with a degree of precision. Beyond this, are found the usual West Coast plants, among them *Thespesia populnea*, *Cocos nucifera* with *Casuarina equisetifolia* and *Calophyllum inophyllum;* while still farther inland the typical vegetation of the Western Ghats and the Deccan Plateau occurs. In the flat country and about paddy cultivation the tree growth consists largely of Karanj (*Pongamia glabra*), Tād or Palmyra palms (*Borassus flabellifer*), Wild Date (*Phoenix sylvestris*), Tamarind (*Tamarindus indica*), Jāmūn (*Eugenia jambolana*), Mango (*Mangifera indica*), Ber (*Zizyphus* spp.), Apta (*Bauhinia racemosa*), Rāyan (*Mimusops hexandra*), *Streblus asper*, Neem (*Melia azadirachta*), and other species. Occasionally Gūlmohōr (*Poinciana regia*), Drumstick (*Moringa oleifera*), Sīmal (*Bombax malabaricum*), Pangra (*Erythrina indica* and *E. stricta*) and Khar Champā (*Plumeria acutifolia*) occur, especially near villages. The scrub and secondary jungle exhibits predominantly bushes and small trees such as *Carissa carandas*, Tōran (*Zizyphus rugosa*)—the latter usually on hillsides—*Ixora coccinea*, *Lantana camara*, *Calotropis gigantea*. The Cobra Cactus (*Opuntia elatior*) is not uncommon in parts, and the roadside hedges and field boundaries are principally the cactus *Euphorbia neriifolia*.

The better wooded parts of Salsette, as for example the country around the three artificial lakes—Tūlsi, Vehār and Pawāi—which provide part of the city's water supply, and the hills in the northern part of the island—contain Teak (*Tectona grandis*), *Grewia* spp., *Albizzia procera*, *Dalbergia* sp., *Garuga pinnata*, *Careya arborea*, *Ficus bengalensis*, *F. glomerata*, *F. religiosa*, *Cassia fistula*, *Feronia limonia*, *Adina cordifolia*, *Gmelina arborea*, *Morinda citrifolia*, *Oroxylum indicum*, *Holarrhena antidysenterica* and other deciduous trees. In addition to many of the bushes common about the open cultivated country, one finds *Helicteres isora*, *Calycopteris floribunda*, *Woodfordia fruticosa* and several species of Karvi (*Strobilanthes*). In the monsoon a host of herbaceous plants spring up, particularly luxuriant in the better wooded northern parts, including various species of *Leea* whose leaves

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Photo by

Powāi Lake, Salsette.
'The Naturalist's El Dorado.'

Sálim Ali.

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afford favourite nesting sites to tailor birds and other warblers. The excellence of the soil of Salsette for mango and *chikoo* cultivation has long been recognised and there are many large orchards and groves scattered over the flatter portions of the island which provide feeding ground and shelter to numerous species of birds. *Loranthus longiflorus*, *L. loniceroides*, *Viscum articulatum* and other *Loranthaceae* are common parasites and affect many species of trees. The former two are particularly damaging to mango trees and they are all entirely bird distributed. In the valleys of North Salsette, bamboo (*Bambusa stricta* ?) is abundant, and though not studied in any ecological detail it is interesting to find that there are patches of forest of evergreen aspect (containing the lianas *Entada scandens* and *Gnetum scandens*) on the top of our highest hills. Larger patches of this type occur on Tūngār Hill across the Bassein Creek.

A large portion of the earth used in the surface filling of the Back Bay reclamation blocks was transported from Kandivli. Along with it came the seeds of many species of Salsette plants which, germinating after the first monsoon, rapidly colonised their new home forming little scattered thickets. With the growth of this vegetation, many birds that had heretofore found nothing to attract them in this locality found ample food and shelter and some, even congenial breeding sites. When the scrub is again cleared and the plots built upon or otherwise utilised, these new colonists will be forced to retreat once more. The Reclamation area, though small in extent, and partly indeed because of it, provides an admirable venue for the study of ecological succession.

General remarks on the Bird-Life.

Besides the resident avian population of Bombay and Salsette there is every year a heavy and conspicuous influx of migrants, which commencing often as early as August reaches its peak by about the middle or end of November. The birds either pass on farther south after a short stop-over—*passage migrants*—or linger in our midst throughout the cold weather months—*winter visitors*—but the vast majority are a mixture of these two classes, some individuals staying on in the locality while others continue their southward journey. With the approach of the hot weather, the migrational tide begins to ebb. The northward exodus commences about the end of February, and by the first week in May most true migrants have departed for their breeding grounds in the Himalayas or beyond into Central Asia and Siberia.

Apart from the true migrants, there is a host of species that move about locally within a more circumscribed range and which may be met with in our area at some seasons of the year but are absent at others. The abundance or paucity of food supply is certainly one of the causes that govern the movements of this class—*local migrants*—but what the other controlling influences may be we as yet know little. Rufous-backed Shrikes, for instance, are common in Salsette from about September to March but retire further inland thereafter, while Pittas and Pied Crested

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Cuckoos usually make their appearance in our midst at the commencement of the monsoon for short periods. The study of local bird movements is a promising subject which may here be recommended to field naturalists in this and other parts of India.

There is yet a fifth class of birds that needs to be mentioned—the *vagrants*. Occasionally these are isolated individuals that have, for some unaccountable reason, strayed far out of their accustomed haunts. The Hypocolius—a Persian bird was recently shot at Kihim across the harbour; while at other times many species may be involved, all driven out of their normal habitat by exceptional and adverse natural conditions. Thus the drought in Gujerat and those parts during 1899 brought numbers of strange birds to Bombay for a living. A flock of 40 to 50 *Chettusia gregaria* appeared and remained for some weeks on the Esplanade where they naturally attracted much attention and were productive of letters in the local newspapers. The heavy gales at the commencement of the South-West Monsoon frequently throw up sea birds like Gannets and Shearwaters on our shores at that season.

Our avifauna does not fall into any well-defined zoo-geographical sub-region. The peculiar Indo-Malayan element of the South-West e.g. the frog-mouths, the spine-tails, the laughing-thrushes, the bazas and many others do not extend so far north. The great tide of Palaearctic migrants that sweeps into India through the North-West reaches and influences our bird-life to the extent to which it affects the Deccan in the same latitudes. But our affinities are not with the Deccan, except in so far as the common birds of India are the common birds of the table-land as well as of Bombay. In the first place we lack a stable and resident population of birds typical of the dry open plains, the sand-grouse, the bustard, the grey shrike, the Indian courser, the black-winged kite, the tawny eagle, various larks and others. But there is another difference that is not easily appreciated—the absence of resident counterparts of migrants like the rufous-backed shrike, the little ringed-plover and the hoopoe. The Western Ghats, of course, are next-door to us, and almost directly continuous with Salsette in the north. And from these Ghat forests our bird-life is enriched by such forms as the trogon, the orange minivet, the black-capped blackbird, the grey-fronted green pigeon, the racket-tailed drongo, and the Malabar whistling thrush. There are, of course, many Ghat species that we have not observed in Salsette, but the nature of the terrain and the presence of conspicuous forms, inclines us to the opinion that our bird-population approximates more closely to that of the hill ranges than of the table-land beyond.

Within the city of Bombay there are indeed few spots still left where one may enjoy the song or company of birds apart from the 'scum of the air'—the kites, crows, pigeons and sparrows —that have adapted themselves to a life of unabashed parasitism on Man and flourish in his midst and by his concerns. Nevertheless it is surprising what a number of other species have unobtrusively managed to acclimatise themselves to the changed and ever-changing conditions of urban life, and may still be met

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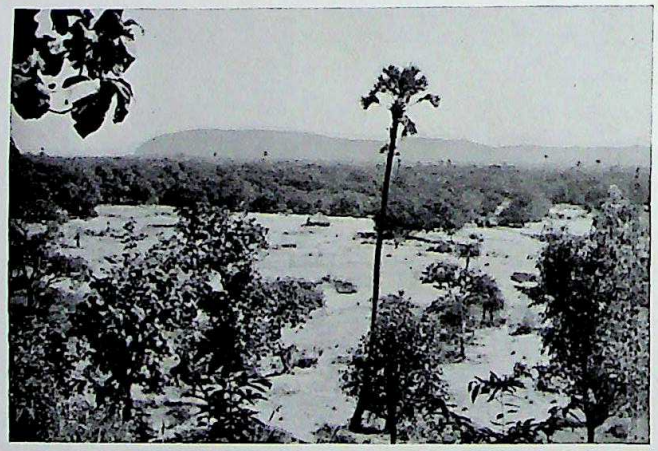
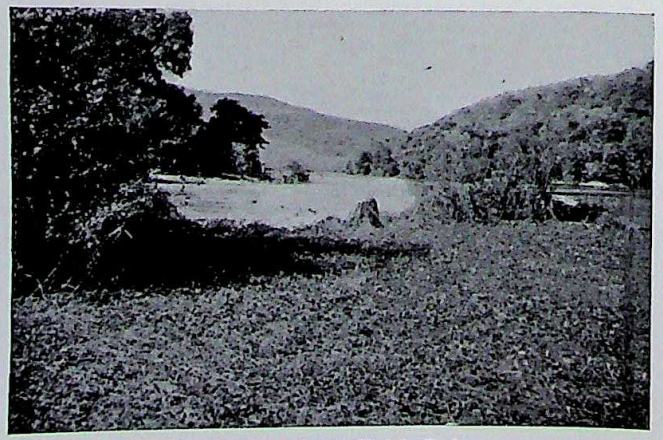
SOME FRUITFUL SPOTS FOR BIRD-WATCHING IN SALSETTE.

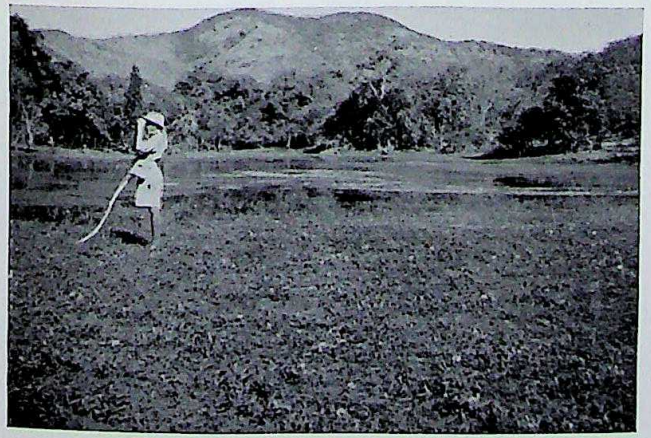


1. View from Mullund Hills, looking east.

2. Trombay Hill (monsoon vegetation).



3. A corner of Tulsi Lake.



4. Tulsi Lake with Borivli Hills in the background.

Photos 1, 3 *and* 4 *by T. E. Waterfield.*

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wherever the least bit of garden or shrubbery prevails, or even amongst our roadside trees. Tailor-birds will nest in a potted croton in the heart of the town, while sunbirds peering out of their pendant nests appear perfectly at home with trams and motor cars roaring past within a few feet of them. In the cold weather wagtails and pipits may still be seen on the various maidans busily hunting insects in among the maze of cricket-nets and the throngs of players, hawkers, loafers and pleasure-seekers, while swifts continue to occupy many of their age-long nesting sites under the porches and eaves of antiquated buildings, since beset by noisy thoroughfares.

The more spacious residential quarters of the town, however, with their gardens and large rambling compounds, as in the Malabar Hill area—unfortunately fast disappearing—are still amazingly rich in their avifauna. Government House grounds at Wālkēshwar form an ideal bird haunt and to this day harbour a number of species otherwise only met with further afield in Salsette. The Victoria Gardens at Byculla afford an island of refuge and a breeding ground to many species amidst an otherwise congested and uncongenial locality.

Apart from the actual deprivation of feeding grounds and nesting sites which has resulted directly from the development or occupation of new or erstwhile sparsely populated areas, the most serious menace that birds have had to reckon with has been, and continues to be, the advance hand in hand with these conditions of the 'boy' and the 'crow'. Both are unavoidable concomitants of urbanisation and both an equal nuisance to bird-life. The mortality in birds' eggs and young traceable to their joint and several depredations is appalling. We have known gardens in the City—then in remoter and less congested localities than now—where but a few years ago such birds as ioras and fantail flycatchers used to breed successfully year after year, but where only rarely in the course of several recent years were we able to observe families of the latter safely out of the nest. Even where they managed to survive the nestling stage, the young invariably vanished soon after, and from the marked attention they had been receiving from these vandals and from the stray cats of the neighbourhood, there seemed little doubt as to who was culpable. After several unsuccessful attempts of this sort, the birds finally deserted the localities presumably in search of less harried surroundings farther afield.

This example is typical of what is happening every day as population advances. Crows are inveterate nest-robbers and in the more populated areas where they abound as a matter of course, it is almost impossible for any eggs or young, especially in open nests, to escape their felony. As long as they go unchecked—and this is the *fiat* of our City Fathers—it is futile to attempt to encourage the smaller and more defenceless forms of bird-life into the precincts of our homes and gardens. Pernicious egg-taking by, and catapults and air-guns in the hands of idle thoughtless boys supplement the sorry work.

In the lesser populated suburbs of Bombay and the cultivated

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and wooded country in Salsette, however, bird-life has still a refuge which, with a little more of intelligent appreciation and a little less of apathy, it should still be possible to retain as a permanent sanctuary. Apart from the natural marauders—birds, beasts and reptiles—a considerable menace to bird-life in suburban areas is that all too familiar breed of local 'sportsmen' who scour the countryside, year in year out, equipped in red loin-cloth and smoking cap and armed with catapults or an ancient fowling-piece; who comb the jungles or prowl about the creeks and village tanks from crack of dawn to slay every living thing that will repay the expenditure of powder and shot. In its immature or 'catapult' stage this breed—Anton, Pascal, Dominic or what you will—is a scourge to small birds, their eggs and young. As imago it possesses knack of almost invariably managing to acquire a gun of sorts, thenceforth transferring its nefarious attentions to every slaughterable creature of the earth and of the air.

Inspite of these conditions, it must be admitted that in relation to its size the bird-life of Salsette is still tolerably rich both in species and in numbers. How long it will be able to hold its own in the face of these powers of disintegration without special protection and an awakening of the public conscience, depends largely upon economic prosperity which is bound sooner or later to complete the work it has begun—the building of Greater Bombay. Unless in the meanwhile the rising generation—the citizens of tomorrow—are taught by means of Nature Study in schools and by intelligently-conducted excursions into the countryside to take pleasure and pride in the bird-life and other natural objects around them, it is unreasonable to expect a change in their outlook or that they will extend the requisite facilities to birds and other creatures to live when this eventuality arises. It is a hackneyed commonplace that protective laws by themselves are impotent unless they have the backing of strong and well-informed public opinion, and there can be no doubt that the seed of public opinion is most effectively sown only in the classroom.

Some of the finest spots we know of in the neighbourhood of Bombay for the watching and enjoyment of birds are in the hilly wooded country between the Tūlsi Lake and the Gōdbunder Creek which forms the northern boundary of Salsette. Trombay, both the lower hillsides and the scrub country around the base of the hills is excellent, while Borivli, Kandivli and the locality about Kanhēri Caves will never fail to repay a morning's ramble. There are now good motor roads throughout Salsette, affording very pleasant and beautiful drives, and the efficient local services of the B.B. & C.I. and G.I.P. Railways bring all the wooded spots within easy and comfortable reach of all.

It is hoped that the publication of this paper will help to stimulate an interest in the bird-life that is fortunately still around us and lead to an appreciation of its true value as an aesthetic as well as an economic asset, and ultimately, to statutory and practical measures for its encouragement and preservation against the onward march of progress and conditions increasingly hostile to its continuance.

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The Jungle Crow (*Corvus m. culminatus*).

House Crows (*Corvus s. splendens*) pilfering from a fishwife's basket.

Photos by

Sálim Ali.

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SYSTEMATIC LIST.

Family: Corvidæ.

The Southern Jungle Crow: *Corvus macrorhynchos culminatus* Sykes.

Local Name: *Dhobia Kaula.*

Field identification: Larger, heavier and more glossy jet black than the Indian House-Crow, and lacking its grey collar and breast. (Often erroneously called the 'raven' or the 'rook' neither of which occur so far south as our area.)

The Jungle Crow is rare within the limits of the city proper, but is a resident of suburban areas and the wooded portions of Salsette where it is fairly common and more or less completely replaces the smaller grey-necked species. It is omnivorous in its diet, but much more of a carrion-feeder than the last named, and may generally be seen at carcases of cattle in company with vultures. It is a great robber of the eggs and young of other birds and is fond of the land crabs that emerge from their aestivation so abundantly during the monsoon months. It is also partial to the nectar of the blossoms of *Erythrina* and *Bombax* trees and a regular visitor to them in season.

A peculiarity noted in this species is the short flights often indulged in with neck outstretched and wings held almost upright and back to back above the level of the body, the tips being flapped through a small arc and the bird cawing in a high-pitched key the while. This is presumably done under stress of some emotion which is usually but not always sexual.

Breeding: In our area the Jungle Crow is an earlier breeder than its grey-necked congener. We have found nesting activities in progress in every month from November (earliest date 26th) to June (latest date 14th), but chiefly between March and May. On 13 May a bird has been observed carrying sticks for a nest, while on the same date a full-fledged young with pinkish gape was on the wing.

The nests are the usual untidy platform-like structures of twigs often with an admixture of iron wire, with a cup-like depression in the middle lined with cocoanut fibre, tow, horsehair or any such soft material available. They are placed in Banyan, Mango or Tamarind trees usually between 20 and 30 ft. from the ground and frequently in the vicinity of villages and outlying huts. A favourite site in Salsette is at the base of the leaf-stalks of Tād (*Borassus*) palms, and many of such nests come to grief owing to the removal of the leaves for thatching purposes before the monsoon. Several other birds such as Swallow-Shrikes, Palm Swifts and Mynas must also suffer considerable mortality on this account.

We have found 4 or 5 eggs to be the normal full clutch in this locality. The Koel (*Eudynamis scolopaceus*) commonly parasitizes the nests of the Jungle Crow. We have never found more than a single young Koel in a nest and these in May and June.

On 9 September (Chembur) an extraordinary attachment to an old nest by a pair—presumably the same birds as had eggs in it on 25 May—was noted. The owners persistently kept in its proximity, cawed concernedly and showed much agitation when it was climbed up to although it was in a somewhat dilapidated condition and contained no eggs.

The Indian House-Crow. *Corvus splendens splendens* Vieill.

Local Name: *Kaula.*

The Indian House- or Grey-necked Crow is unquestionably the commonest and most ubiquitous bird in the city of Bombay and in the more densely populated of its suburbs. He is universally and perhaps justly reviled, but it is impossible to overlook his usefulness in keeping the city clean of refuse. However much one may resent his practices or deplore his morals, one cannot but admire his masterly finesse and cunning in invariably getting the better of his fellow-citizens, not excluding Man himself. Whether he is manoeuvring to deprive you of your *chota hazri* toast, or shadowing your movements to despoil a well-concealed nest as soon as your back is turned, there is in his tactics the same well-calculated shrewdness that places him without dispute in the front rank of avian intelligentsia.

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The Crow is a born opportunist. His capacity for discrimination between a harmless person and one not to be trusted, and between a stick and a gun is truly uncanny. Climb up to his nest and handle the eggs or young and for weeks afterwards you will be singled out from among your fellows for special attention, even though you appear differently attired on each occasion. Execrations will be lavished upon you at sight and you will even be subjected to assault and battery at the bills of the outraged owners.

Much has been written about the Crow, but the subject is still far from exhausted. Indeed, as long as human ingenuity persists so long will the Crow continue to afford matter for study and amazement as he will continue to devise counter-measures to deal with any new situation that may arise in order that he may still get the better of Man and profit by his concerns.

In the matter of diet the Crow is omnivorous and not exacting. It is this that makes him a blessing—albeit a mixed one—to civic life, and confers on him the patronage and protection of our City Fathers. No species of garbage comes amiss to him and he seems to thrive on everything. But while being a staunch ally of our health authorities in the maintenance of an efficient sanitary standard on the one hand, he also helps to promote disease on the other. In Chaupati Road, S. A. once watched a crow hop into a milk-man's shop while the owner was away in a back room. The bird sidled up and on to the rim of a vessel containing the stock-in-trade, already popular with the fly community of the neighbourhood, and inserting his head into it, took several long and refreshing draughts! As the bird had quite possibly been feeding the moment before on the entrails of a sewer rat, or maybe something still more gruesome, it is not difficult to imagine his potentiality for the dissemination of disease germs.

With all this, however, it must be said that Crows are cleanly birds outwardly, and punctilious about their toilet. They never miss the opportunity of a bathe and runnels of water or ornamental ponds such as there are in the Victoria Gardens always have their quota of regular bathers. We have also observed them frequently washing themselves by shuffling among the dense and dripping foliage of trees like *Gulmohor* or *Karanj* after a shower of rain.

They are amongst the regular habitues of *Erythrina indica, E. stricta* and *Bombax malabaricum* in bloom and revel in the nectar of the blossoms. Specimens shot off them show a considerable quantity of pollen adhering to their forehead and chin, and the birds undoubtedly play an important part in the cross-pollination of these flowers. Parties frequently indulge in hunting winged-termites as they emerge from the ground on monsoon evenings, often till well after dusk. The birds either post themselves on the ground near the hole and tick off the insects as they appear, or else launch aerial sallies after them from roof-tops and the like, often going through remarkable evolutions in the chase. We have seen one take a complete somersault—loop-the-loop—in the air! One of their favourite hunting grounds is fish-markets where they cause endless annoyance to the fish-wives, sneaking up to the baskets and pilfering from them, both on the ground and off the women's heads and just managing to keep out of their irate reach.

With a high wind blowing, numbers of these birds frequently indulge in aerobatics involving considerable agility, for no apparent reason except the mere fun of the thing.

Breeding: House-Crows breed abundantly within town limits and also about the local railway line, and all through the better populated suburbs. The season proper may be said to last from May to August, although in some years it may begin considerably earlier and last till about the middle of September. The earliest date on which we have observed a bird tugging at and breaking off a dry twig from a growing branch is 18 February (St. Xavier's College compound). On 21 February we have a record of a half-built nest in the Victoria Gardens and on the 23rd of the same month another was nearing completion in a roadside tree opposite the Royal Opera House. The earliest date for young we have is 9 May when two were being fed in a nest near the Andheri railway station.

During the season almost every roadside tree in the town holds a nest, often two or more. The locality about the B.B. & C.I. Railway line between Grant Road Station and Dadar seems particularly favoured, as also that in the neighbourhood of the docks. Here a large number of nests are composed

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more or less entirely of iron wire or scraps of hoop iron filched from the neighbouring goods yards. This propensity to utilise iron wire in the structure of the nests was responsible for great interruption and delays in the suburban electric railway service when it was first inaugurated in 1922. The engineers had reckoned without the Crow which soon discovered that the overhead brackets holding the power wires provided admirable nesting sites and took to them wholesale. The iron used in many of the nests caused short-circuiting and brought traffic to a standstill. Thus in one week 44 trains were held up, and it was with some difficulty that the cause was finally discovered. Not until a specially designed insulated or crow-proof bracket was introduced was this nuisance finally eradicated.

The nests are mostly placed in trees—Mango, Tamarind, *Albizzia, Casuarina, Polyalthea,* palms and others—from a height of about 12 ft. up, mostly between this and 20 ft. In structure they do not differ from those of the Jungle-Crow except that, owing to its greater availability in town, iron wire etc. is more employed in its construction. There is the almost classic example of a nest built entirely of gold and silver spectacle frames pilfered from an optician's shop in the Fort. About Rs. 400 worth of frames disappeared before the culprits were run to earth!

Three to five eggs are normally laid and the largest number of young we have seen in a nest is four. In our experience two is the largest number of young being tended by the parents out of the nest, and it appears that the mortality in the nestling stage is heavy. The Koel habitually foists its eggs on the nests of the House-Crow. On 9 (June 1931) H. A. found a nest with 11 Koel eggs of two different types which appeared to have been laid by two different females. There were no crow's eggs in the nest, but signs of a broken egg which may have belonged to the latter (*J.B.N.H.S.,* xxxv, 458). We have usually seen a single young Koel being tended by its foster-parents out of nest; only on one occasion two. Never have there been any young crows about, and it might be questioned as to what becomes of them and whether like the European Cuckoo the young Koel also heaves its foster-brothers over the edge of the nest.

Various stages of albinism have been noted and described in the House-Crow in and around Bombay city. One that occurs more frequently than others is the isabelline phase of which an example bred for two years at least in the Government Dockyard (1924 and 1925). For those who still believe in the popular notion that crows mate lying on the ground with their vents apposed, it may be mentioned that we have now observed them mating in the usual manner of birds—'treading'—a sufficient number of times to dispel this fallacy. Popular belief also credits the crow with exceptional longevity or even immortality. The argument advanced is that in spite of its abundance, one seldom comes across a crow that has died a natural death; a fact that is indeed true enough of most wild animals.

The Crow has few natural enemies and but for the heavy mortality in its nestling stage and other periodical checks, its numbers would soon become unendurable. A few years ago a mysterious disease appeared among the crow population of Bombay which evoked a good deal of correspondence in the local press at the time. Large numbers of adult birds were found lying dead in many parts of the city and suburbs, in a stiffened condition, beneath their perches. The Haffkine Institute investigated the matter but as far as we are aware without elucidating any clue to the mystery.

This account of the House-Crow has become inordinately lengthy, but there is so much of interest in the life of this pre-eminently urban bird that it could not be compressed further without doing him an injustice.

The Indian Tree Pie: *Dendrocitta vagabunda vagabunda* (Latham).

Field identification: 'A bright rufous magpie with sooty head and neck, and impressions of grey, black and white in the wings and tail' (Whistler, *Popular Handbook of Indian Birds*).

Specimens: *St. Xavier's College*: 134 ♀ 15-8-33 Powāi; 214 ♀ 13-12-34 Borivli (H. A.); *Bombay Natural History Society*: o? 16-3-24 Vihār Lake (S. A.).

Elsewhere noted: Chembūr, Trombay, Gōdbunder, Kandivli, Mulund, Thāna, Marōl.

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Resident. The Tree Pie is fairly common in the better wooded portions of Salsette, frequenting lightly forested hillsides and occasionally also gardens and orchards in the suburbs. It is usually met with in noisy pairs or small parties of 4 or 5 birds. It has a large variety of calls, both harsh and pleasant, some of them being very similar to those of the Black-headed Oriole. It is very destructive to the eggs and young of small birds, and also feeds on lizards, young mice and grasshoppers and other insects. *Bombax* flowers are largely visited in season for their nectar. Mr. McCann informs us that he observed one in Salsette feeding on the ripe fruit of 'Kaundal' (*Trichosanthes palmata* Roxb.). This is strange since according to Roxburgh (Kirtikar and Basu, *Indian Medicinal Plants*, i, 580) the fruit is poisonous and, mixed with rice, is employed to destroy crows!

Breeding: We have not taken any nests in Salsette, but have seen three full-fledged young in company with one of the parents on 9 July.

Family: PARIDÆ.

[The Southern Grey Tit: *Parus major mahrattarum* Hartert.

Not in Salsette, but we have observed it on the adjacent mainland at Vāsind, Tānsa Lake, Kasāra, Igatpūri, Nāsik and elsewhere.

Breeding: Capt. Betham (*J.B.N.H.S.*, xii, 78) records it nesting in the neighbourhood of Poona in June and July.]

Family: TIMALIIDÆ.

The Bombay Rufous Babbler: *Turdoides somervillei somervillei* Sykes.

Malacocircus somervillei of EHA.

Local Name: *Khekata* or *Sāt-bhai*.

Specimens: *St. Xavier's College*: 11 ♂ 6-8-33 Marōl (H. A.).

Field identification: Untidy, earthy-coloured bird slightly smaller than Myna, with loose tail. In small squeaking flocks.

Noted: *Bombay and Salsette*: Government House Grounds, Wālkēshwar, Parēl, Dādar, Pāli Hill (Bandra), Andheri, Sion, Kandivli, Borivli, Malād, Gōdbunder, Mulund, Thāna. *Adjacent mainland*: Pārsik, Kihim, Alibāg, etc.

Resident. The Bombay Babbler is a common bird in the suburbs of Bombay and all through Salsette, as well as on the coastal portion of the mainland opposite. It frequents residential compounds, mango orchards and groves of trees in flocks or 'sisterhoods' of 6 to 8 birds, which rummage among the fallen leaves for insects. Some grain is also eaten while the ripe berries of *Lantana camara* are much favoured. The birds are invariably present on *Erythrina indica* and *E. stricta* in season—and also to a lesser extent on Simal (*Bombax*)—probing into the blossoms for the nectar. They do valuable service in cross-pollinating them.

Usually perfect amity prevails amongst the members of a sisterhood, but occasionally differences of opinion arise between individual members or between two separate sisterhoods, and desperate encounters ensue with much recrimination and flying of feathers. The whole flock rallies to the encounter engaging with members of opposing flocks, rolling on the ground interlocked and plying viciously with bill and claw. The battles are of short duration, however, and it is not long before harmony is restored.

Babblers may frequently be seen shuffling themselves and bathing among the dripping foliage of a bushy tree after a shower of rain. This appears to be a common bird habit. We have seen White-throated Babblers and several other species doing the same, besides Crows which, as mentioned before, indulge in it freely.

Breeding: This Babbler evidently breeds irregularly throughout the year. We have found nests in various stages of building or with eggs and young and also immature birds of all ages (never more than two with a pair) in almost every month, but principally between April and November. Barnes (*J.B.N.H.S.*, iv, 245) found it breeding at Sion in June and July.

The flocks do not break up at any time, but breeding pairs detach themselves occasionally for their domestic duties, though continuing to feed in company.

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The nest is rather an untidy shallow cup of fine twigs and rootlets. It is flimsy in structure and the contents or sky can usually be seen through from underneath. It is placed in the fork of mango—especially bushy grafts—*Asūpāl* (*Polyalthea*), and similar densely foliaged trees at between 7 and 30 ft. from the ground, but most often under 15 ft.

The full clutch consists of 3 to 4 beautiful greenish-turquoise eggs.

The Pied Crested Cuckoo commonly foists its eggs on the nest of this Babbler. Elha (*N. & E.*, i, 80) records a pair followed by a young one and a young cuckoo at Bombay, and we have observed the manoeuvres of this cuckoo in its cuckolding quest at Kihim (26 August 1930).

The Common Babbler: *Argya caudata caudata* (Dumont).

Field identification: Small brown bird, boldly streaked above, and with long loose graduated tail. 'Looks like a miniature hen pheasant in flight' (Whistler). Size about that of a bulbul.

Specimens: *St. Xavier's College*: 72 ♂ 8-9-33 Gōrēgāon; 86 ♂ 25-9-33 Jūhū (H. A.).

Noted: Andheri, Bassein; 8 miles from Thāna on Poona Road.

Resident. The Common Babbler is very rare in Salsette, as it is on the coastal strip of the adjacent mainland. It inhabits dry open scrub country. It has not been observed by us in the neighbourhood of Kihim (Kolāba District) at all during the course of several years watching.

Breeding: From the condition of their gonads both the specimens (8 and 25 September) were evidently breeding. The testes of the former were enlarged to 15×10 mm. On 25 April (1935) a pair was observed accompanied by two juveniles just out of nest on a small scrub-covered hillock at Andhēri where a sisterhood of 6 to 8 birds is known to be resident.

The breeding season here is apparently as ill-defined as it is in other parts of its distributional range.

The Deccan Scimitar Babbler: *Pomatorhinus horsfieldi horsfieldi* Sykes.

Field identification: A dark-coloured skulker, usually in dense forest or bamboo jungle, with a curved yellow beak and a prominent white eye-brow. Size slightly larger than Bulbul.

Specimens: *Bombay Natural History Society*: o? 2-8-25 Kandivli; ♂ (607. 9-9-28) Hills on Thāna-Gōdbunder Road (S. A.). *St. Xavier's College*: 170 ♀ 19-11-33 Borivli (H. A.).

Noted: Gōdbunder and the wooded hills in North Salsette; Parōl Pāra and Salāo (Kolāba District); Ghāts (Mahābleshwar, Panchgani, Khandāla, etc.).

As pointed out by Messrs. Kinnear and Whistler (*J.B.N.H.S.*, xxxv, 742) birds from our area are really intermediate between the large pale race with a long beak—*P. h. obscurus*—from the north-western portion of the range of this species, and the richly-coloured race from the south-west—*P. h. travancoreensis*. Our specimens have practically no trace of the rufous tinge on the back, and in this particular approximate more closely to the latter form.

Resident. The Scimitar Babbler is not uncommon in the well-wooded northern parts of Salsette. It is partial to bamboo patches and low dense bush jungle on the hillsides. The birds usually move about in small scattered flocks of 4 to 7 individuals and are very shy, keeping to the seclusion of thick cover and seldom showing themselves. Their mellow gurgling 'whistles' however invariably give away their presence in any locality, and they can be decoyed long distances by an imitation of their calls. Their food consists largely of insects which are picked off the branches and trunks of trees as well as rummaged for among fallen leaves in typical babbler fashion.

'An unidentified Cuculus (*C. micropterus*?) reproduces the call of this species to perfection' (H. A.).

Breeding: We have no information concerning its breeding in Salsette, but elsewhere in its range it is said to do so between January and May.

The White-throated Babbler: *Dumetia hyperythra albogularis* (Blyth).

Field identification: A small bird of a light brown colour, and a pure white patch on the throat. Size about that of a sparrow.

Specimens: *Bombay Natural History Society*: o? 7-6-25, o? 14-6-25 Chembūr (S. A.); o? juv. 23-9-28 Vehār, o? ad. 30-9-28 Vikhrōli (McCann). *St. Xavier's College*: 51 ♂ 19-8-33 Gōrēgāon (H. A.).

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Noted: Government House Grounds (Malabar Hill), behind Gaikwar's Palace (Nepean Sea Road), Somerset Lodge grounds (Warden Road), hills on Thāna-Gōdbunder Road, Andhēri, Jogēshwari, Mulund, Powāi; Kihim, Alibāg and elsewhere in Kolāba District.

Resident. In 1926 (July) S. A. found this little Babbler quite common in the jungly undergrowth of bushes and scrub on either side of the main drive through Government House grounds by the Wālkēshwar Road entrance. The environment in this secluded locality was eminently suitable for this species, and we suspect that the birds seen at the only two other places within town limits subsequently were stragglers from the colony resident here. We have no more recent information concerning the grounds. Possibly there may be other rambling compounds in the Malabar Hill area still capable of affording refuge to the species for some time longer.

In the northern part of Bombay island and all through the scrub and wooded country about the foot of the hills in Salsette, the White-throated Babbler is not uncommon. It is usually met with in flocks of 10-12 birds which hop about restlessly amongst tall grass stems and undergrowth, or on the ground below, in search of insects. The members keep up a low 'cheep-cheep' or 'swee-swee' of about the volume of a sunbird's calls, varied occasionally by harsher twittering notes, especially when agitated.

We have frequently observed them feeding on nectar from the flowers of *Erythrina indica* and *E. stricta*, two common trees in Salsette.

Breeding: The breeding season proper in this area commences in the latter part of June after the rains have well set in and the luxuriant growth of monsoon vegetation is up. It lasts till September, but the best time is undoubtedly till the beginning or middle of August. We have records of nests in various stages as follows: 4 July ('32) Andhēri; 18 July ('26) Government House grounds (Malabar Hill); 30 July ('35) Mulund; 20 September ('25) Chembūr.

On 29 August ('26) a three-quarters grown young in loose juvenile plumage and stub tail was observed with parents at Chembūr, while the specimen collected at Vikhrōli by Mr. McCann on 23 September ('28) was one of a party of 3 juveniles lately out of nest.

The nest is a neat ball-shaped structure about 6 in. in diameter, composed on the exterior of coarse grasses or bamboo leaves with the entrance hole on one side. It is lined with finer grasses. Eha (*C.B.B.*, 85) writes of one he found in a Bombay garden that was made of the curly paper shavings used in packing eau-de-cologne bottles.

It is usually placed from 3 to 6 ft. from the ground in a 'Ber', *Ixora* or other thorny bush, often overgrown with monsoon creepers. Humayun Abdulali found one at the base of the leaf-stalks of a small date palm at a height of about 3 ft.

Three to four eggs is the normal clutch. They are white in ground colour, spotted and blotched all over with reddish-brown.

The nests from 'Tanna and Khandalla' recorded by Wenden (*J.B.N.H.S.*, iv, 241) as belonging to *D. h. hyperythra* doubtless were of this form.

The Yellow-eyed Babbler: *Chrysomma sinensis sinensis* (Gmelin).

Field identification: 'Small rufous bird with white under parts and a rather long full tail; orange eyelids are conspicuous' (Whistler).

Specimens: *Bombay Natural History Society*: o? 21-3-24, o? 14-6-25, ♀ 17-11-27 foot of Trombay Hills, Chembūr (S. A.). *St. Xavier's College*: 68 ♂ 8-9-33 Gōrēgāon (H. A.).

Noted: Kandivli, Borivli, Kanhēri Caves, Mulund, Powāi, Trombay, Thāna-Gōdbunder Road, Pārsik etc.; Kihim and elsewhere in Kolāba District; Nāsik.

Resident. We have not come across this Babbler within the limits of the city proper, but it is common in scrub jungle about the suburbs and in Salsette generally. It goes about in small parties of 4 or 5, hunting among the bushes and grass stems for insects and occasionally clinging upside down in the manner of a tit. The note usually uttered is a clear, loud and somewhat plaintive 'cheep', but sometimes—and frequently during the breeding season—the males clamber up to exposed situations and utter a loud and pretty song. These Babblers are amongst the usual habitués of the Coral tree (*Erythrina*) in season, and feed extensively on the nectar of its blossoms.

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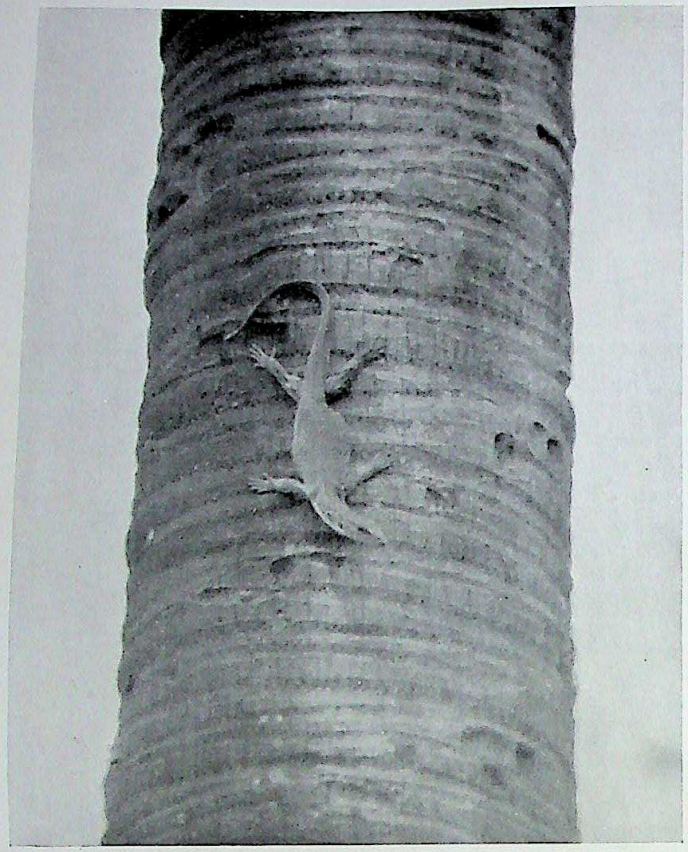

Photos by

Circumstantial Evidence! A Monitor Lizard descending Palmyra palm containing Myna's nest. Chembūr, Aug. 1927.

Sálim Ali.

Nest of the Yellow-eyed Babbler (*Chrysomma s. sinensis*). Note owner crouching within.

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Breeding: The breeding season is during the rains, principally from July to September. We have records of the following nests: 9 July ('28) Powāi; 18 July ('35) Trombay; 5 August Powāi; 29 August ('26) Chembūr; 9 September ('28) Hills on Gōdbunder-Thāna Road; 22 October ('33) Kihim.

N. & E., vol. i, p. 97, mentions a clutch of 5 eggs taken on 10 October and a nest with 3 chicks and 1 egg on 30 October at Igatpūri.

The nest is a beautifully built deep cup of coarse grasses lined with finer material and is usually sparsely to moderately cemented on the outside with cobwebs. It is hung hammockwise between the upright stems of grasses or monsoon plants, or wedged into some crotch of a bush, from 18 in. to 4 or 5 ft. from the ground. The supporting stems or twigs are incorporated into the wall of the nest which is sometimes carefully concealed and at others absurdly conspicuous. When approached closely, the incubating bird slips off the nest, but skulks away through the undergrowth for some distance before taking to wing. It returns to the nest in the same circumspect manner.

The cup is so deep that the contents are seldom visible unless looked at from directly above. When incubating—especially when crouching low at the approach of an observer—all that can be seen of the bird is its beak sticking obliquely up at one end of the nest and its tail at the other. The eye peers just over the rim and surreptitiously follows the movements of the intruder.

Four eggs comprise the normal clutch in our area. They are fairly glossed yellowish-white in ground colour (with a pinkish tinge when fresh) and finely speckled with purplish-brown. . . . In shape they are roundish oval and measure about 17×15 mm.

Both sexes incubate and feed the young. The period of incubation has not been determined, but the young leave the nest 12 or 13 days after hatching.

The Spotted Babbler: *Pellorneum ruficeps ruficeps* Swainson.

Field identification: Small fluffy olive-brown bird, usually skulking in undergrowth, on or near the ground running about like quail; a reddish-brown cap; whitish under-parts with breast heavily streaked. Size little larger than a sparrow.

Specimens: *Bombay Natural History Society*: 3 juveniles 16-9-28 Hills near Gōdbunder (S. A.); ♀ 1-1-09 Andhēri, ♂ 22-9-12 Borivli (N. B. Kinnear). *St. Xavier's College*: 35 ♂ 16-7-33 Powāi, 44 ♀ 23-7-33 Kanhēri, 98 ♀ 28-9-33 Borivli (H. A.).

Noted: Mulund; Kihim, Parōl Pāra, Mahābleshwar and other wooded localities in the Thāna, Kolāba and Satāra Districts.

Resident. The Spotted Babbler is not uncommon in the well-wooded hilly portions of Salsette. The birds are seen singly or in pairs, skulking in thick undergrowth or rummaging among fallen leaves on the ground in search of insects. They walk or run along the ground like quail, but also proceed by long hops in the typical 'seven sisters' manner. The birds are usually shy and retiring, but curiously enough they are remarkably tame at Kihim where they commonly keep about the hedges in the village and its precincts, sometimes even entering the verandahs of tenanted dwellings. The usual call-notes have often been likened to a plaintive '*Pret-ty sweet*'. They have also been rendered elsewhere as '*He will beat you*', '*He'll beat you*' or merely '*He'll beat*'. These are repeated every two seconds or so for quite ten minutes or more at a time. Besides, it has a loud and percussive song of several whistling notes rambling up and down the scale, and more frequently heard during the breeding season. It is uttered from some elevated perch. The alarm call is a loud '*kraa, kraa, kraa*' etc. with the throat feathers bristling.

Breeding: We have not taken the nest of this species in Salsette but the breeding season here seems to be the monsoon. The three specimens collected on 16 September were juveniles, lately out of nest, and juveniles in company with parents have also been observed on 30 August at Kihim, and one rescued from village urchins on 3 September. The number of young usually accompanying parents is 3 or 4.

The nest is a rough globe-shaped structure of grass and leaves placed on the ground under the shelter of a stone or bush.

As pointed out in the Hyderābād State Ornithological Report (*J.B.N.H.S.*, xxxvi, 379) the statement on p. 238 of the *Fauna* (vol. i) that this Babbler apparently does not breed below about 2,000 ft. is erroneous. Kihim is on the

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sea-coast and the whole of Salsette is also well under that elevation, but there is no doubt as to the species breeding in these localities.

The Bombay Quaker Babbler: *Alcippe poioicephala brucei* Hume.

Field identification: A rather slim babbler, with the usual nondescript olive-brown plumage and a grey cap. Size about the same as last.

Specimen: *Bombay Natural History Society*: ♂ 20-11-27 Kandivli (McCann).

Noted: Hills near Tūlsi Lake; Parōl Pāra (Alibāg Talūk), Rōha (Kolāba District); Mahābleshwar, etc.

Resident (?). The Quaker Babbler is rather rare in Salsette and confined only to the well-wooded hills in the north of the island, where we have come across it sporadically and sparingly. It is essentially a bird of wet forest of secondary aspect and as such, much more common at Mahābleshwar and in areas of heavy rainfall on the Ghats.

The birds move about restlessly in flocks of 5 or 6 individuals among the foliage of tall trees as well as in bushy undergrowth, hunting for insects. Two or three such flocks may frequently be seen together and in association with other avian species. The males have a pretty trilly whistling call or 'song' of 4 notes, of the consistency of a Magpie-Robin's, which is constantly uttered and is usually the first intimation of their presence in any locality.

Breeding: We have no information as to whether this Babbler breeds in Salsette.

The Central Indian Iora: *Ægithina tiphia humei* Stuart Baker.

Iora zeylonica of EHA.

Local Name: *Cheroka.*

Field identification: Male in breeding plumage 'a black and yellow bird about the size of a tomtit. The top of its head, with all its back and upper parts, is as black as a newly-brushed boot, with a white band across the wings . . . the whole under parts, from chin to tail, are a bright gamboge yellow' (Aitken). In the female the black is replaced by greenish-yellow. The male in winter loses much of the black and is then very similar to the female.

Specimens: *Bombay Natural History Society*: ♀ 7-2-24 Pāli Hill (Bandra) (S. A.); ♂ (No. 208.31-12-07) 26-3-99 Trombay Island (Major H. J. Walton); ♂ (No. 1376.31-12-07) 27-11-99 Hog Island (E. Comber). *St. Xavier's College*: 23 juvenile 6-7-33 Gōrēgāon (H. A.).

Noted: *Bombay city*: Khētwādi and Girgaum (1914); Chaupāti, Malabār Hill, Victoria Gardens, Fort, Colāba, etc. *Suburbs and Salsette*: Bandra, Santa Cruz, Khār, Andhēri, Borivli, Kandivli, Chembūr, Thāna, Powāi Lake, Mulund, Bhāndūp, Gōdbunder, Elephanta Island and on adjacent mainland. More or less ubiquitous.

Resident. The Iora is a common and familiar bird both within the limits of the city and suburbs and also farther afield. It frequents gardens, mango orchards and secondary jungle usually in pairs which hunt for insects among the foliage of trees, the birds keeping in touch with each other by mellow whistles and short musical chirrups. The nuptial display consists of the male chasing the female about impetuously from branch to branch and tree to tree, posturing before her with wings drooping, rump feathers arched and fluffed out and tail slightly cocked, to the accompaniment of chirruping notes, a variety of musical whistles or a long drawn '*chee-ee*'. Another very familiar and spectacular turn in the display consists of the male springing perpendicularly from a branch several feet up into the air, hovering, fluffing out and exhibiting his white rump feathers and parachuting down like a fluffy ball.

Breeding: We have taken or seen nests in the city and suburbs at Khētwādi (1913), Malabār Hill, Andhēri, Bandra, Chembūr, Borivli and elsewhere, too many to enumerate.

The season in our area and on the adjacent mainland is from May to September, our earliest date being 5 May and latest 4 September. July and August is the best time for eggs. The normal clutch here is almost invariably of three eggs, but sometimes—probably in the case of second layings—two are found.

The nest is a beautiful compact cup of fine grasses or fibres, well and

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neatly plastered over with cobwebs. It is placed in a crotch of twigs from 4 to 30 ft. from the ground, but oftenest between 6 and 12. Either the supporting twigs and leaves are worked into the wall or firmly wound round with cobwebs. Mango, *Bauhinia,* Lime (*Citrus*) and Ber (*Zizyphus*) trees are largely favoured.

The eggs are pale pinkish-white, blotched with purplish-brown and measure about 17·5×14 mm.

Both sexes partake in building the nest, incubation and tending the young. The nest in one case took five days to build and there was a pause of a day before the first egg was laid. The eggs are laid at intervals of about 24 hours and—as far as we have been able to ascertain—only early in the mornings. Incubation commences from the first egg, both sexes brooding more or less alternately, but it is fitful and irregular (even in wet weather) until the full clutch is completed. We have only found the female brooding at night.

The number of eggs and young of the Iora that come to grief is appalling. Within town limits the chief culprit is the House-Crow, with the Boy a good second. In the suburbs and outlying parts of Salsette, Jungle Crows, Crow-Pheasants, snakes, monitor and *Calotes* lizards do considerable destruction.

The Malabar Gold-fronted Chloropsis ; *Chloropsis aurifrons frontalis* (Pelzeln).

Field identification: Similar to the next, but with the forehead touched with bright gold. The chin is black in adults of both sexes, but pale green in the young.

Specimens: *Bombay Natural History Society*: ♂ ♀ 28-11-27 Mulund Hills overlooking Tūlsi Lake (S. A.); ♂ 22-10-28 Tūlsi Lake (McCann). *St. Xavier's College*: 7 ♂ 23-7-33 Tūlsi Lake (H. A.).

Noted: Kandivli, Gōdbunder, Kihim, Rōha, etc. (Kolāba District).

Resident. The Gold-fronted Chloropsis or Green Bulbul is fairly common in the better wooded parts of the island, especially in the environs of the three lakes in Salsette which furnish the city's water supply. It is thoroughly arboreal in its habits, and hunts systematically among the foliage of trees for insects, clinging upside down and in all manner of acrobatic positions in the search. Being of a grass green colour and harmonizing admirably with the surrounding leaves, it is oftener heard than seen, but even so it is such an accomplished mimic of the calls of other birds that it frequently passes for them and is overlooked. We have heard it imitating to perfection the following species: Tailor-bird, Red-whiskered Bulbul, the defiant Shikra-like notes of the Black Drongo, Iora, White-breasted Kingfisher, Rufous-backed Shrike and several notes of the Magpie Robin. The calls are often very puzzling since they are produced long after the originals have left the locality on seasonal migration, a fact which postulates a remarkably retentive memory on the part of the mimic. The different impersonations follow one another in quick succession without a break, and convey to the hearer an impression that a plenary session of a veritable avian League of Nations is in progress! On approaching the tree from which this Babel emanates, a solitary Chloropsis or a pair fly out and the illusion is at an end. Its own call or 'song' of several notes is wedged in between the imitations.

Insects and spiders form a large part of the diet of this Chloropsis, but berries are also eaten and the nectar of many flowers is regularly imbibed. We have observed it in this quest probing into the blossoms of *Erythrina, Bombax* and *Calycopteris floribunda*.

The adult female shot on 28 November had less and duller orange on the forehead and the blue cheek- or moustachial-streaks somewhat less defined, but the chin and throat were black and not pale green as have been described for this sex in the *Fauna* (i, 348). The latter description in reality applies to first winter birds of both sexes as pointed out by Messrs. Whistler and Kinnear (*J.B.N.H.S.*, xxxv, 752).

Breeding: We have no data in regard to the breeding of this species in Salsette.

Jerdon's Chloropsis : *Chloropsis jerdoni* (Blyth).

Phyllornis jerdoni of EHA (who appears to have confused it with *aurifrons*).

Field identification: A beautiful grass green bird with the chin black in the male and blue in the female. Size about that of a Bulbul.

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Specimens: *Bombay Natural History Society*: ♂ 20-12-23 Andhēri (Prater); ♀ 22-3-24 Gōdbunder (S. A.). *St. Xavier's College*: 6 ♂ 27-7-33 Borivli (H. A.).

Noted: Kandivli (Salsette), Kihim, Parōl Pāra, Rōha, etc. (Kolāba District).

Resident. A fairly common species in Salsette and a bird of somewhat opener country than the last, frequenting mango orchards, gardens, groves of trees and thin forest.

It is also an excellent mimic and there is not much in its voice, habits or food to distinguish it from its Gold-fronted congener. On Coral trees in bloom, where it is a regular habitué, it plays the blustering bully, attacking and driving away every other bird feeding on the nectar not only in its immediate vicinity, but often a good distance away in another part of the tree. Sometimes we have even observed it acting dog-in-the-manger and driving away birds from the flowers by swooping down on them repeatedly from a neighbouring tree to which it returned after each sortie.

On one occasion (8 September 34) Humayun Abdulali observed a pair capturing (and eating) red ants (*Œcophylla smaragdina*) on a mango branch. Every ant caught in the beak was quickly but deliberately rubbed into the tail feathers before being swallowed. Humayun Abdulali speculates that this process may help to wipe off the unpalatable formic acid from the squeezed victims. A separate note on this interesting observation has been published by Sálim Ali elsewhere in this *Journal*. (vol. xxxviii, pp. 628-31).

Breeding: We have not been able to obtain any first-hand evidence, but EHA (*C.B.B.*, 93) has taken a nest and thinks that March and April is the usual season here. It is said to be a loose cup-shaped structure placed at the end of a branch of some large tree. Two or three white eggs with claret coloured spots are laid.

The Grey Hypocolius: *Hypocolius ampelinus* Bonap.

Specimen: *Bombay Natural History Society*: ♂ 14-11-30 Kihim (Kolāba District).

Vagrant. The normal habitat of this bird is Persia and along the shores of the Persian Gulf. The record of its occurrence in our neighbourhood is an exceptional one, there being altogether not more than two or three others for the whole of the Indian Empire.

Further particulars regarding the specimen will be found on page 1061 of volume xxxiv of this *Journal*.

Family: Pycnonotidæ.

The Red-Vented Bulbul: *Molpastes cafer cafer* (Linnaeus).

Pycnonotus haemorrhous of EHA.

Field identification: 'Cheerful smoky brown bird, with its face and fine crested head glossy black. The "under-tail coverts" as they are called in polite society are crimson' (EHA).

Specimen: *St. Xavier's College*: 9 ♂ 22-1-33 Andhēri (H. A.).

Noted: *Bombay City*: Warden Road, Malabār Hill, Government House grounds, Khētwādi and Girgaum (1913), Chaupāti, Victoria Gardens, Willingdon Sports Club grounds and elsewhere. *Suburbs, Salsette and adjacent mainland*: Pāli Hill, Bandra, Khār, Trombay Hills, Chembūr, Powāi Lake, Borivli, Gōdbunder, Thāna, etc.; Kihim, Ūran, Alibāg, Elephanta Island and elsewhere in Kolāba District.

Resident. The Red-vented Bulbul is a common and familiar species of gardens and residential compounds, both within city limits and in the suburbs. It also frequents the low country in Salsette generally, being less common in the hills where its Red-whiskered congener more or less replaces it. Along with numerous other bird species, it feeds largely on the nectar of flowers especially *Erythrina* and *Bombax*. We have also observed it nipping open the explosive buds of *Loranthus scurrula* and *L. longiflorus*, probing into them for the nectar and transporting quantities of pollen on its forehead.

Among the berries commonly eaten and for the seed dispersal of which this and other Bulbuls are undoubtedly largely responsible in our area, may be mentioned *Lantana camara, Streblus asper, Mimusops hexandra, Vitis* sp.,

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Flacourtia montana, *Jasminum malabaricum* and *Loranthus* spp. Some insects are likewise taken. Flying termites are greatly relished and we have also seen several birds hopping about on the ground picking up small black ants emerging with their eggs from a hole.

Breeding: We have taken or seen nests, too numerous to detail, between the end of April and the beginning of October. The nest is a cup of rootlets with sometimes a little cobweb on the outside, placed at heights between 3 and 30 ft. from the ground but oftenest under 10 ft. The site selected is usually shrubs, creepers in verandahs, stunted date palms, cactus hedges, Ficus sprouts in wells or old walls etc. A particularly favourite site on the coast is the pollarded Bhendi (*Thespesia*) trees, and pruned Guava grafts in gardens seldom fail to attract the birds.

The normal clutch in these parts consists of two or three eggs which are pinkish-white in ground colour, more or less profusely blotched with purplish-brown or claret. There is considerable casualty among the nests due to rain, wind, etc., and the mortality among eggs and nestlings is heavy—lizards, snakes, crows, crow-pheasants, koels and boys being some of the agents that contribute to it.

The eggs are laid early in the mornings at intervals of about 24 hours. Incubation commences with the first egg as a result of which there is a marked disparity between the sizes of the chicks in the nest.

The White-eared Bulbul: *Molpastes leucogenys leucotis* (Gould).

Sind or Persian Bulbul of EHA.

Field identification: General appearance like the last, but with the cheeks white and the patch of crimson under the tail replaced by sulphur yellow. Size same as last.

Specimen: *St. Xavier's College*: 8 ♂ 16-8-33 Gōrēgāon (H. A.).

Noted: Vikhrōli (Salsette); Rēwas (Kolāba District).

Status uncertain, but apparently a recent immigrant and fast establishing itself as a resident. Our impression is that this bird, first reported to us by Mr. C. McCann in 1928 as a surprise straggler in our locality, has since been on the increase—though very gradual (see *J.B.N.H.S.*, xxxvii, 221). They are either descendants of escaped cage birds that have established themselves and multiplied, or represent a southward extension of range from Gujerat where the species is common, or both these factors operating together.

'In Salsette and across the Harbour, at Rēwas, they are always seen associated with *Clerodendron inerme* and *Salvadora persica*. As these plants do not grow far from mud-flats, the birds are also seen in similar terrain. The same association was also observed at Cambay (Gujerat) where the bird is common.' (H. A.)

The Southern Red-whiskered Bulbul: *Otocompsa jocosa fuscicaudata* Gould.

Local Name: *Inglees Bulbul* or sometimes *Mahābleshwar Bulbul*.

Field identification: 'Sprightly bird . . . dark brown above, white below, with a white patch on the cheeks, and a broken gorget across the breast; a crimson tuft below the eye and a similar patch of colour under the tail' (Whistler). It has a perky crest often likened to Mr. Punch's cap. Size same as last.

Specimens: *Bombay Natural History Society*: o? 16-3-24 Vihār Lake (S. A.). *St. Xavier's College*: 69 ♂ 8-9-33 Gōrēgāon (H. A.).

Noted: Warden Road, Malabār Hill; Pāli Hill—Bandra; Powāi Lake; Chembūr, Trombay Hills, Borivli, Kandivli, Andhēri, Gōdbunder, Thāna, etc.; Kihim, Alibāg and elsewhere in the Kolāba District and also in the surrounding country.

Resident. The Red-whiskered Bulbul is easily the commonest bird in the hills of Salsette where the jungle has been cleared and dense scrub (mainly *Lantana camara* and *Holarrhena antidysenterica*) has taken its place. Within city limits and in the suburbs it is less abundant than the Red-vented Bulbul.

It is of a tame and confiding disposition and in food and habits closely resembles the last-named.

It seems remarkable that such a keen naturalist and observer as EHA should have fallen into the error of saying about this bulbul (*C.B.B.*, 89) that:

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'. . . the cheeks (or ears) of the male are crimson and those of the female pure white'. This, of course, is incorrect as the adult sexes are indistinguishable in appearance, both having the red 'whiskers'. In young birds, however, the red whiskers are lacking and the undertail coverts are a pale orange-rufous or salmon colour.

Breeding: The breeding season in our area lasts from March to October, and we have records of numerous nests during these months.

The nest is similar to that of the Red-vented Bulbul and placed in bushes, hedges or small trees generally from a few inches to within 7 or 8 ft. of the ground. Occasionally the site selected is the thatch or palm-leaf walls and roofs of tenanted huts, the birds sitting complacently on their eggs or feeding the young within a few inches of the inmates. The normal clutch consists of two or three eggs which are similar in colour and markings to those of the Red-vented species. The period of incubation is 15-16 days. Two, or sometimes even three, broods are frequently reared or attempted in succession, the casualty among the eggs and young being amazingly heavy.

Both birds share in the construction of the nest, rearing of the young and presumably also in incubation. The nest takes three or four days to complete and there is usually a pause of a day—sometimes two—before the first egg is laid. The eggs are laid at intervals of about 24 hours and early in the morning i.e. approximately between 6 and 7-30 a.m. Brooding sometimes commences fitfully from the first egg, but the nest is left unattended through long periods of the day and during night until the full clutch has been laid. Incubation is taken up earnestly thereafter though in the early stages it is often very intermittent during the day.

Although strictly speaking outside the scope of this paper, a distributional peculiarity of the Red-vented and Red-whiskered Bulbuls in a neighbouring area of the adjacent mainland is perhaps here worthy of note. The distance between Mahābleshwar (4,500 ft.) and Panchgani (4,400 ft.) on the Western Ghats is about 10 miles, yet the average annual rainfall at the former is between 225 and 275 inches while the latter receives only about 60 inches, both during the South-West Monsoon. The Red-whiskered Bulbul is one of the commonest birds about Mahābleshwar as is the Red-vented species at Panchgani, either to the more or less complete exclusion of the other. About two miles from Lingmāla Falls towards Panchgani stretches the almost sword-cut line of demarcation between the zones occupied by the two species and along this may also be said to lie the boundary between the evergreen vegetation of the humid, heavy-rainfall area of Mahābleshwar and the drier, deciduous country as about Panchgani.

The status of the Bulbuls in these two popular hill stations is so remarkable that it cannot fail to strike even a casual observer.

The White-browed Bulbul: *Pycnonotus luteolus luteolus* (Lesson).

Ixos luteolus of EHA.

Local Name: *Khar-bulbul.*

Field identification: 'A clumsier bird than the other bulbuls, uncrested and clad in an unaesthetic garb of brownish-greenish olive, passing into dusky greenish-yellowish white on the under parts. There is no bright colour about it, but its eye-brows are conspicuously white. A loud, abrupt, rattling snatch of a song.' (Eha). Size as of the Red-vented Bulbul.

Specimens: *Bombay Natural History Society*: o? 8-3-24 Pāli Hill—Bandra (S. A.); (No. 604.3-7-28) 22-6-28 Malād (E. Henricks). *St. Xavier's College*: 10 ♂ ?-8-33 Gōrēgāon (H. A.).

Noted: Warden Road, Cumballa Hill; Pherozesha Mehta Gardens and Government House grounds, Malabār Hill; Haffkine Institute grounds, Parēl; Khār, Andhēri, Trombay Hills, Chembūr, Borivli, Kandivli and elsewhere in Salsette; Uran, Kihim, Alibāg, etc. across the Harbour.

Resident. This bulbul is common in the gardens of the outlying residential portions of the city and suburbs, and also in the scrub country at the base of the hills in Salsette.

It goes about in pairs, but is oftener heard than seen as it bursts forth every now and again into loud abrupt snatches of song. It is usually shy, but a pair observed in the shrubbery bordering the Pherozesha Mehta Gardens on Malabār Hill (July 1925) appeared to have become thoroughly sophisticated

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and were not at all perturbed by the proximity and bustle of the throngs of people out to 'eat the air' on a Sunday afternoon. From their behaviour it was evident that they had a nest in the shrubbery near the Post Office end of the garden. We have no recent information as to whether these birds still persist, but thanks to the presence of many suitable gardens and compounds in that neighbourhood, they are very probably still there.

The food of this bulbul consists of berries and fruit of many kinds, the more prominent species among them being *Lantana camara, Mimusops hexandra, Streblus asper* and various Fici. Spiders and insects are also eaten but to a lesser extent.

Breeding: The season lasts from early March to the end of August. Lt. H. E. Barnes (*J.B.N.H.S.*, iv, 249) found it breeding on Mount Sion (Salsette) in July and August. Aitken (*N. & E.*, i, 190) found a nest with c/2 on 14 September, and we have seen a nest with two newly-hatched chicks as late as 3 October. It is possibly double-brooded.

The nest is similar to that of the Red-vented Bulbul and is composed of rootlets etc. without any extra lining. It is flimsy and loosely put together. The site selected is in some low bush such as Lantana or Karonda (*Carissa*) seldom more than 4 ft. from the ground. The highest noted by Humayun Abdulali was in a date palm at about 15 ft., but it was never completed. One of our nests (containing young) was placed in (or on) the leaf of a young date palm about 12 in. off the ground. The leaf overhung a used cattle path, so that it must have been constantly brushed aside and violently shaken by the animals passing to and fro!

Almost invariably two eggs are laid, but Humayun Abdulali has once found only a single. The owners do not create the usual bulbul row when the nest is being pried into or handled. They merely sit at a distance and utter a low '*krr-kurr*' etc. of displeasure and concern at intervals which may be abruptly switched on into the merry rattling song.

(*To be continued*).

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SHOOTING NOTES FOR THE CENTRAL PROVINCES.

BY

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(*With a plate*).

The following notes are submitted in the hope that they may be of assistance to impecunious sportsmen, like myself, who are unable to budget in thousands for their annual shooting holiday. That shikar and a lively interest in Natural History is not necessarily a rich man's pastime can be amply proved by the results I have obtained. It was the chance remark of a young friend in the Indian Army, who deplored the fact of his inability to go on a month's shooting trip due to the expense involved that induced me to write these notes.

The first recommendation I have to make to anyone wishing to shoot in the Central Provinces is to buy, beg, borrow or steal a copy of Dunbar-Brander's classic work, *Wild Animals in the Central Provinces*. With the help of the wonderful notes on the Fauna of the province, their habits, hints on shikar etc. one cannot fail to succeed in obtaining good trophies, and a complete education in the ways of the Wild. Make this book your constant companion at home and in the jungle, study your failures and successes in relation to Brander's observations, and you will in one month learn what our predecessors took years to discover by experience. Before going to your shooting block, please remember that there are several methods of transport. Except for short distances up to 200 miles or so a car is an expensive luxury. It is all right to get about in, but no shooting is permitted in the Government Reserved Forests from cars, and very rightly too. Besides one can see far more game in one's block by getting about on one's flat feet than in a car.

It is not essential to travel first class by rail, especially in a case where a journey of 500 miles is involved; with a certain amount of discomfort a friend of mine travelled 700 miles recently by intermediate class, and at a fraction of the cost of first class travel. I think it worked out at one-quarter of the cost, and was the only means by which he could balance his shooting budget. During the trip he improved his knowledge of the language, and the nature of the country to a remarkable extent, so much so that meeting a landholder of the United Provinces in the compartment he got an invitation to shoot there when he had some further leave. Most shooting parties move out from the District station of their block by bus or taxi; to date I had always done so and paid heavily for the doubtful privilege. This year, however, due to Election 'fever' not a single conveyance was available, so that I was compelled to fall back on either bullock-cart or pony tonga. I chose the latter and got a very pleasant surprise. Two ponies were harnessed to each tonga, of which I had

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My orderly *Sajnoo Shikari.*

Tiger male 9 ft. 8 in. Mandla 1936.

Spotted Deer 35 in. Mandla 1936.

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two to fit myself, servants and kit; and they got me to my block, a distance of 42 miles in ten hours including halts for resting the ponies and food. I have never enjoyed a trip as much before. It was a unique experience and at the same time a very satisfactory mode of transport inasmuch as my total expenses were a paltry Rs. 16 as against Rs. 42 usually paid to the *bus-wallah*. So much for cutting down expenses for the route. There are several other ways of economising, that will suggest themselves to the reader; I for one never beat for tiger, partly on account of the expense, and also due to the fact that in a beat for a guest of mine, where I accompanied the beaters, a wounded tiger turned back and just missed bagging me. From that day I have decided that it is not fair to the beaters to ask them to drive tiger with sticks and stones, when the sportsman with a rifle is safe up a tree. When writing to the Forest Officer of the District you have decided upon visiting, for a block, ask for two or three blocks at least, this enables him to allot you one in case any of the others are already reserved. It is best to write a couple of months ahead for the block. The block fee is Rs. 25 a month plus Rs. 10 for the new Game license, which the District Forest Officer can obtain for you from the Deputy Commissioner of the District. After obtaining your block, write thanking the District Forest Officer and ask him to let you know the best site to camp, and the nearest route from the Railway station or District Headquarters, also ask for the address of the Range Officer responsible for your particular block. So far I have found the Forest Officials in the Central Provinces very helpful and courteous in their dealings with me. On obtaining this information, arrange your plans, write to the Range Officer, informing him that you will be reaching the block by a certain date and request his assistance in the matter of *bodas* (buffaloes for tying up) and a reliable shikari. This officer is usually an Indian and, whilst being above accepting any gratuity from you, he can appreciate common courtesy. His help is invaluable and is freely given, though it is no part of his duties to cater for sportsmen. Having established contact, proceed to your block, take your rifles, kit, tentage and stores with you. Dealing with these I have the following advice to give:—

Rifles. A heavy double-barrel H. V. rifle is a necessity if any serious tiger shooting is going to be done (mine is a 450/400 D. B., H. V.). Especially in the case of following up a wounded animal the value of a quick second shot is most felt. A double-barrel permits of a very quick snap-shot being taken and in such circumstances is much more accurate than a bolt action single barrel type. Take soft nose split bullets for tiger, panther, deer and similar game, and a few solids for bison if you are lucky enough to be allowed one on the permit, and what is more, to find one. I have found twenty rounds quite sufficient for a month's shoot, in fact, I have only fired twelve rounds out of this rifle in two shoots, and only in one case was a second shot required on an animal.

Next, a medium weight rifle is useful, mine is a ·300 Spring-

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field bolt action. This is light enough to be carried by the sportsman in his wandering round the jungles; is deadly accurate in taking the very often barely seen neck shots offered by sambhur and cheetul and in every way will prove its utility in bringing down black-buck, barking deer, pig etc. Whether to take a 12-bore shot gun or a ·22-bore rook rifle is a moot point. I favour the latter, as one can pot doves, *jungli moorghi*, etc. for the pot with the minimum of noise. A most essential proceeding if you are after tiger. Several shikaries I know use the 12-bore with buckshot or ball on tiger and panther. Unless the gun is a paradox pattern one, I most strongly recommend that it is not used in this way. With luck an animal is shot dead, but in most cases, especially as regards tiger, a follow up is the result, with danger to the sportsman or the unfortunate villagers who may encounter the wounded beast. During my last three shoots I have left my gun at home, as I found it quite superfluous on shikar, and one can with a little practice obtain excellent results with a rifle.

If you are in a district where the use of a torch is permitted at night for shooting; take it every time; with a good clamp arrangement to attach it to the rifle one can obtain deadly shots on any sort of night, dark or moonlight. Without the torch one has to chance a shot at somewhere on the tiger's body during a sit up. With the torch one can place a shot in the neck which will drop the tiger or panther where he stands.

A good pair of binoculars is most useful, as also a set of country-made skinning knives. Very often skinners are not obtainable and this means having to skin an animal with often enough very crude assistance from the junglies.

For tentage I recommend an ordinary 40-lb. 'officers' pattern double fly for oneself, with a grass hut, which the villagers will run up in a couple of hours for the servants. A canvas tarpaulin is useful for keeping off the rain from the servants, or for taking with one when after bison; as very often in this latter case one has to camp out in the jungles miles from camp.

A portable machan, laced with khaki-dyed *newar* tape, is excellent for sitting up, not only is it more comfortable than a village *khattia*, but it is not likely to creak at a critical moment.

As regards stores, one has one's own fancies in tinned provisions, it is advisable to buy these at your home town and bring them with yourself. All bazar provisions, such as flour, ghee, salt, sugar, etc., can easily be purchased from the District Headquarters nearest to your block. This does not apply to small wayside stations and one has to make arrangements to bring everything. At these latter places the only conveyance usually available is bullock cart, and don't expect these to move in mountainous country more than 16 miles a day. Don't forget to take about 8 lbs. burnt alum and some arsenical paste for treating skins with. It is very difficult to get alum in the interior, also a couple of hundred 3-inch nails for pegging down skins with. These are far more useful than bamboo pegs and do not tear a skin half as much.

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Having discussed most of the shikari's requirements, I leave out petty odds and ends such as clothes, water bottles, lamps etc., servants are the next problem. I find that a good cook and an orderly are quite sufficient. The former is an absolute necessity, the latter if he has been to the jungles before a most valuable perquisite. He can superintend the tying up of *'bodas'*, dry curing of skins, cleaning equipment and the hundred and one odd jobs that crop up in camp.

A stock of essential medicines such as quinine, iodine, salts, aspirin, permanganate, etc., is very helpful, in fact during the winter months when the jungles are still very damp—quinine, or one of its many compounds is essential to keep off Malaria. Dose yourself and your servants regularly as fever can ruin the best arranged shoot. When you are leaving your block make over your medicines to the Range Officer. He will appreciate them for himself and the poor villagers who have helped you in your holiday. In the jungles medicine is a Godsend, whereas back in civilisation it is always available.

Having settled where you will go, how you are to get there, and worked out your programme, expenses etc., decide what animals you mostly wish to shoot. This depends entirely on yourself and the type of game available in the district. Roughly speaking, the distribution of game is as follows:—

Tiger, panther, bear, spotted deer, sambhur, barking deer, in most or almost all districts of the Central Provinces.

Bison in Mandla, Balaghat, Raipur, Chanda and other districts south of the Nerbudda.

Swamp deer (*bara-singha*) in Mandla only. Shooting in other districts is prohibited as these fine animals are getting very scarce.

Buffaloes are preserved throughout the province, as they are very scarce and only available in the Raipur District.

To illustrate actual experiences let me describe a recent shoot. Getting down at Mandla Fort this February, I called on the District Forest Officer whom I had met out shooting the previous year, to make my 'Salams' and get the latest news of my block. In passing I may mention that this particular gentleman is one of the finest officers that I have met in my wanderings throughout India, scrupulously fair in his dealings with shikaries, and always ready to help a fellow sportsman. You will find his type the rule rather than the exception in the Central Provinces and Government forests elsewhere throughout India. After a hearty breakfast, which I enjoyed, being ravenously hungry, I set out in search of a bus or taxi to get me to my block, with the result already shown. However the tonga journey was a novel—and to me intriguing experience, being as I am very keen on horses of any description. I reached my block the next day as I broke journey about half way to get a decent sleep in the last dak-bungalow on the road. Arriving at the Range Officer's headquarters I was given a cordial welcome as he was an old acquaintance from the previous year. Armed with all the newest *'khabbar'* and with all arrangements for shikaries and *'bodas'* complete I pushed on to the

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village recommended to me by the District Forest Officer on foot, a distance of 16 miles, the luggage coming on by bullock cart. Camp was pitched about 8 p.m. and after a healthy dinner of village *moorghi* and *'chappaties'* washed down with the last of the beer I had, prospects of shikar were discussed over a roaring log fire. It was ascertained that there were two, quite probably three tigers in the block, and that one of them lamed in a beat some twelve years back and consequently called *'lungra'* by the villagers, was not only remarkable for his size and weight, but also very bold in his dealings with human beings, having mauled a couple of beaters and cowherds during his career, and distinguished himself by nearly pulling a sportsman out of his machan the previous year. Withal, he was said to be remarkably cunning. This was a pleasing prospect, further set off by Sajnoo the shikari waking me up at 4 a.m. to hear a big *bara-singh* stag roaring. I have been after a good stag for two years but without success and life was indeed rosy.

It was decided not to fire a shot until 'Lungra' was brought to bag, so that concentration was set upon the tie-ups. The first three days brought disappointment to everybody; myself because no kills were made, the shikaries because I would not fire at an enormous wild boar that we met early one morning on our way to inspect the *'bodas'*. The fourth day was memorable; coming down from a high hill where we had sat to look out for *bara-singh* in an adjoining maidan we disturbed some animal near a small spring on the face of the hillside. The wavy motion of the high grass indicated a tiger moving off, but it was impossible to get a glimpse of him due to the dense grass which was at least 8 ft. high. A careful examination of the spot from where he had moved disclosed this as a favourite lie up of the famous 'Lungra'. There were several forms, both old and new where he had rested, and hair and pugmarks in plenty. These latter bore out the statements of the junglies, that the tiger was very massive. They were huge and I could fit eleven fingers in the indentation of the pug. Furthermore the right foot turned inwards considerably indicating some defect or deformity in the conformation of the foot. A start was immediately made for camp by a round-about way to avoid disturbing the tiger more, and at Sajnoo's suggestion we started talking in ordinary tones, cut a few bamboos etc., as if we were just woodcutters in the jungles by chance, as it was known that the tiger was very suspicious and any hint of unusual activity in the jungles sent him in hot haste to safer quarters. A sudden barking of a barking deer quite close at hand on the opposite face of the valley seemed to indicate that the tiger was watching us, and a look through the glasses showed that the deer was stationary, barking furiously at something in the bamboo covert, the chattering of a pair of magpies round and about a particular spot also indicated the presence of the tiger. That night a buffalo calf tied on the direct path leading down from the hillside at a place called Karipahar was taken by *lungra*, he had however bitten clean through the fore leg by which the bait was tied near a suitable machan tree and taken it right

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away. The long and short of it all was that we never found a trace of the kill. This was a gloomy outlook, and indicated an extraordinarily cunning beast. Strategy was essential to get a chance at him, so the next night three bodas, all carefully selected for size were tied up in the same spot. Instead of the usual picketing peg, each beast was tied to a fairly long and heavy log of wood, which it could drag to some distance, and the rope was passed around the base of the horns. The scheme succeeded. Next morning disclosed two of the bodas hale and hearty, but some distance from their original picketing point, they had bolted on seeing the tiger and got held up in the jungle by the logs to which they were tethered. A pool of blood in the path of the third beast's drag showed that a kill had taken place and, what was more, the tiger had dragged *boda* and log leaving a clear trail to follow. The next step was to get some of the village buffaloes and after taking lunch and getting all the requisites for sitting up, to follow up the drag in such a way that the tiger thinking we were village cowherds had no suspicions that we were after him. Beating was impossible due to the unbroken nature of the forest and to the genuine fear the villagers had of this tiger. It took us forty minutes to locate the kill in a dense bamboo thicket on a steep face of the hillside. Had I not seen for myself how the 2-year buffalo calf complete with tethering log, had been dragged up that hill through dense coverts and over fallen trees 3 and 4 ft. high off the ground; I could never have believed a tiger capable of such remarkable strength. It was a revelation of a tiger's strength, a path like the track of a roller marked the progress of the tiger and his kill. It was just as well that we had taken the precaution of locating the kill with buffaloes as the tiger was sitting near the kill in dense bamboo cover when we found it and was seen moving off across a small nullah. He was going calmly and without fear, looking back at the buffaloes who had grouped together on getting sight of him. Unfortunately I was examining the kill at the time and so missed a chance of getting him as he crossed the nullah. Hastily and with the minimum of noise a machan low down in a bamboo clump was made, well screened with small bushes. I settled myself down at 4 p.m. and my men moved off with the buffaloes talking loudly. At 5 the tiger crossed the nullah, I could not see him, but distinctly heard the thud as he jumped down the bank, after that two magpies kept me informed of his every movement, he crossed the nullah on my right rear, and carefully circled across my front, not showing an inch of his hide, and with long pauses behind bushes or bamboo clumps. Having made a complete circle I next heard him sniffing where I had had my tea right behind me, at this time I thought that he would locate me as he was only a few yards behind me and I was very low, not more than 6 ft. off the ground. After this there was silence for a few minutes and he started circling around the kill again, this time he made enough noise in the bamboos but was very careful of showing himself. I only got a very occasional glimpse of his back or tail. Having satisfied himself that the coast was clear he

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started moving away to cross the nullah on my left rear and gave me a splendid shot from about 5 yds. I saw him clearly, his eyes were searching the trees in the vicinity of the kill and the slight movement I made in raising the rifle caught his attention. He stopped dead. Whether it was the shock of discovering me or whether it was his intention to pull me out of the machan, I cannot tell, but he threw his weight back on his hind legs in the attitude of springing. This was his last action. A shot in the neck laid him out, with hardly a movement except for a spasmodic twitching of the tail, and a couple of deep breaths. By this time, 5-30 p.m., I was feeling the strain. He had kept me on the alert for 1½ hours, and the shock of discovering that a tiger was cunning enough to look up for a machan, the first instance of the kind in my experience, set my nerves tingling. Honestly I felt funked, realising that I had been horribly careless about the whole show. After giving him time to die comfortably I got down from the machan and had a look at him with the torch. He was a magnificent tiger, by far the best I have ever shot or seen shot. He taped as he lay 9 ft. 8 in.; with a short tail he was unusually massive, measuring 16 in. round the wrist, with an immense head. His shoulders were square at the top, and his quarters developed to such an extent that he looked like an exceptionally well fed pony, with a depression along his back about two fingers deep along the line of his backbone. He was very pale in colour with wide spaces between the black markings, indicating an old beast. I was sorry that I had no machine to weigh him. Sajnoo and the other forest villagers assured me that they had a personal knowledge of this animal for the past fifteen years, partly due to the deformity of his right fore foot. This on skinning was found to be due to a bullet, traces of which were found encysted in the skin near the wrist joint, having broken one of the bones of the fore arm, which had healed, and also shattered one of the numerous tendons of the leg, thereby causing the foot to turn inwards. The wound was quite healed except for a peculiar raw patch on the skin covering the cyst where the bullet was embedded. This I think was due to the tiger having fallen into the habit of licking the spot, either to stop irritation, or merely from force of habit, as the wound appeared to be of very old standing. That night was further remarkable due to my getting an awful fright; after seeing the dead tiger, I got out my blanket and lay down near the machan on the ground for a comfortable sleep, as the machan was too cramped and my men had not turned up with a lantern to take me back to camp. About 1 a.m. there was a terrible scuffling and roaring going on at the edge of the forest. I woke up and was up the machan in about three seconds, whilst the sounds of terrific fighting went on close by. Roaring, snarls, terrific crashing in the jungle kept me fearfully excited in my machan for about half an hour after which the sounds of strife passed on. It was definitely tigers, but what on earth had happened. Morning and my men brought enlightenment; it appeared that a strange tiger following up the *gowlies'* cattle had taken one of my tie-ups, but had been driven off

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the kill by another tiger from the range. As the fight took place almost across the path by which my men were to come for me they decided to call it a day, and leave me on my machan, whilst they went back to camp as hard as they could move.

After that luck deserted me in every sense of the term, both tigers in their fight crossed my block boundary, and were promptly bagged by a shikar party who had the next block. There was one possible tiger left but as he had his beat across the hills in a neighbouring Native State, and only crossed into my jurisdiction at rare intervals, the chances of getting him were remote. I put out three tie-ups, on all the roads by which he was known to come into the block, but for several days nothing turned up.

Meanwhile every effort was made to get a good *bara-singha* stag, but though several groups of hinds were seen and one immature stag, the big stag that we had heard calling on my first night eluded me. At last he was disturbed out of a remote maidan, in size about half of an average polo-field, by some wandering cowherds. A frantic search of two days showed that he had crossed the road into another block, which was for practical purposes a sanctuary, as one stag had already been shot there at Christmas. Moreover the block was not mine, and disappointment for the second year faced me. Everything went wrong, following up recent traces of a solitary bison, we put up a fine sambhur stag, pucca 40 in., by the time I changed my solids for soft nose bullets in the rifle he got away; and we never saw him again. Terribly disheartening, and I regretted not having taken the shot with the solids I was loaded with. After all this down came the rain and as I was camping light, miles away from camp, everything including myself got a severe drenching. Malaria which attacks me at the most awkward times set in and I was laid up for five days. During this period there was a kill where we were tying up for the State Tiger, but this turned out to be only a panther. He gave the woman who was bringing in milk to my camp a fright by growling at her and disputed the pathway on which he was eating the kill, in the morning; not having bothered to drag it a few yards into a convenient nullah. Impudence of this nature deserved punishment, more especially as my wife was frightfully keen on a skin to match one I had got her the previous year, for making up an evening coat. Being too shaky to walk I rode the Ranger's pony to the scene of the kill and sat up on a shaky machan, which wobbled alarmingly every time I had a go of ague. The panther obliged however by not keeping me waiting more than forty minutes. He was a short way up the hillside and I could distinctly hear him scratching himself occasionally; as he was coming up to the kill, a barking deer set up a continuous noise, and next I heard a tiger 'pooking' from the other side of the hill. At the time I thought it was a sambhur, and taking no further notice I waited till the panther was below my tree and laid him out with a shot behind the shoulder, a neck shot being too chancy in my shaky state. As he rolled over gasping and struggling, a heavy beast crashed up the hillside for a short distance, after which all was silent. My

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men came up and asked what I had fired at, I told them panther and showed the animal to them. Sajnoo then went a short way up the hill, and when he came back his face was eloquent enough. The pugs showed that a tiger had been moving on to the kill, had 'pooked' seeing the panther and fled at the sound of my shot at the latter. The panther on being skinned disclosed that the whole of the chest and neck were one mass of fresh clawmarks and scars, with a deep hole on the back of the neck. In fact he bled quite freely from this latter hole when we were carrying him back to camp. By this time I was too far gone with fever to even consider sitting up for the chance of the tiger's return, which was a wise decision as he never came back. The problem, of course, which I leave my readers to solve for themselves, is, Who made the kill? and did the panther which was a big beast 7 ft. 8 in. in length drive off the tiger after a fight, or did the tiger drive the panther off, and on his leaving the kill in the morning the panther took his chance for a few mouthfuls. Also in the evening did the panther attempt the same trick to get a meal before the tiger put in an appearance. Anyway I never saw the tiger again.

After this luck changed and one morning whilst I was trying for a barking deer, which I got, and incidentally one that is almost a record, the right horn measuring 7 in. from the base to tip, excluding pedicle, we came across the grandpapa of all the bears in the block. My shooting was atrocious and it took six shots to finish him off, after a chase lasting the best part of three miles up hill. During the course of the chase he turned and came at us from above twice, once right up to within 4 ft. of me; but the fates were kind and a shot turned him in each case so no damage was done. He was a monster almost as round as a beer barrel.

So far I had been extraordinarily lucky as I had bagged the best tiger and bear that it had ever been my fate to see, but leave was drawing to a close and I had to make tracks homeward. As a last effort however I went to a small bit of jungle just alongside the main road, where I had heard that there were several spotted deer, and I wanted a good stag to take his neck and mask skin to mount a good 34 in. head I had at home. The entire morning and evening failed to show up a good stag, and I wasn't going to offend the Forest Officer by bagging a small head. However next morning when the carts were moving off I had another go, and, as I was coming out of the forest on to the road, I caught sight of a stag and a couple of does feeding across a grassy nullah. Moving into place for a shot, a lovely stag showed himself behind a bush. One quick look through the glasses showed that he had a fine head in hard horn, being February this was rather early for this; the shot was a long one every bit of 250 yds. and no rest available. He was only showing his neck and head, but the little Springfield carried true and he went down with a broken neck—35 in. on the beam with a beautiful symmetrical head, though rather light in girth.

Besides the above game mentioned, some pig were shot for

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the shikaries, one being a fine boar with $8\frac{3}{4}$ in. tushes. Several sambhur were seen but except for the big stag that got away nothing worth adding to a collection consequently none were shot. The same applies to the only *bara-singha* stag put up. Two bison were disturbed, but as their tracks showed them to be cows, they were not followed up.

The above represents what a shikari of average means, determined to work hard for his trophies can get in a shoot lasting 17 days in the jungle, excluding time taken in getting to and from there, in this case 6 days. Besides the above the author has obtained a 42 in. sambhur, a 24 in. black-buck, besides other game in the Central Provinces which shows that there are good enough heads obtainable.

I think the following measurements may be taken to represent shootable game:—

Sambhur, shoot nothing under 38 in.

Bara-singha, nothing under 33 in. and full 12 points, though sometimes a 35 in. or 36 in. head with only 8 and 10 points can be had, in this case I think a shot is legitimate.

Spotted Deer, 32 in. and over should be your aim.

It is impossible to set a standard on barking deer or 4-horned antelope, though a black-buck under 20 in. in the Central Provinces is the rule rather than the exception in hilly country.

Bison, of course, is limited to a solitary bull, and in such cases the horn is usually worn down considerably at the tips, and would not go to much over 26 in. in length. Girth and spread would count as deciding factors in a case like this.

Don't forget that you are limited to one of each species in your permit, so that a hasty shot at an immature animal may well cost you a glorious trophy, which in nine cases out of ten you will come across when your limit is shot out. Besides which it is not fair to shoot a poor *bara-singha* or bison, considering the comparative rarity of these two species. Nor is it cricket to shoot a herd bull of the latter species, you may get away with it; but rest assured that if the District Forest Officer finds out no excuse will be accepted, and besides a heavy fine, you will find that your future applications for blocks are turned down.

There are far too many tigresses with cubs or bears with cubs shot, by keen though ignorant sportsmen. The same applies to animals that are much too small to furnish a trophy worth the expense of mounting. Let such animals go, even if they kill your baits; your forbearance will be rewarded sometime. Shoot panthers of any size, as well as wild dogs as they are a pest and destroy a lot of game.

Regarding the previous remarks two instances stand out rather vividly in my memory. The first case was where during a shoot the writer spared a small tigress with two cubs that came on to the kill, and kept him intensely interested whilst they fed. Later on another sportsman (?) shot the same tigress over a kill and one of the cubs, which was hardly 7 ft. in length. The other after starving for some days was beaten to death by some villagers with sticks. This was in zemindari forest where such things can

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happen. This man's greed over one small tigress wiped out the entire family, which in a few years would have produced at least some trophies worth keeping.

Another case was where a shikari, and an Englishman at that, who went on a tour of three months' shooting in several blocks. He bagged ten tigers, of all sizes, of which he had two skins mounted and advertised the rest for sale. What good did he do, he neither kept the trophies himself and by his action deprived some other sportsman of getting a tiger.

Especially as regards tiger and bear, there appears to be a mistaken impression that quantity not quality is the hall mark of the shikari. It would be a very good thing if the Government set a limit on the tiger permissible to be shot in any one block during one year, with a further restriction in the number allowed per permit. As it is, tigers are being shot out of existence and have disappeared in several areas, where formerly they were quite common. Surely, the tiger requires as much protection as deer, and can be classed as game to the same extent. It is the tiger that brings the sportsman and the sportsman that helps to keep down poaching. Take away the tigers, and very few men would spend their time and money in the jungles. Poaching would increase enormously, and the flow of ready cash, so important to the poor forest villagers in lean times, would soon cease. This is a question that would bear careful investigation.

As some indication of the expense involved in a shikar trip to the Central Provinces, I may mention that the expenses of the shoot described, excluding rail fares, but counting all else, including conveyance to the block, cost of *bodas*, and fresh provisions totalled Rs. 220; a figure that is low enough to be within the means of most of us. If one intends to beat for tiger, then an additional Rs. 40 per beat has to be budgeted for. I had four *bodas* killed out of 6 tied up and the cost of these four was Rs. 32 with another Rs. 4 as *bakshis* to the owners of the two remaining, which they took back. Rewards to *shikaries* depend entirely on one's means, but I usually give Rs. 10 per tiger and bison; and Rs. 5 for bear, panther and *bara-singha*. I find one shikari at Re. 0-8-0 per day, one gun-bearer at Re. 0-6-0 per day, one *boda-wallah* to each tie-up and two spare men to assist around the camp and with machans etc., all at Re. 0-4-0 each a day ample for my requirements. I usually give Re. 1 to the *boda-wallah* whose tie-up has been killed, as also to any villager or cow-herd who brings in news of a natural kill. This ensures keenness. Sites for the tie-ups are all selected by myself and the shikari in consultation, and after careful examination of the block; and the tie-ups are not moved from their sites until it is certain that no tigers are in that part of the block, as a tiger has a very extensive beat, and may take several days to cover it in his rounds.

Boda-wallahs whose *bodas* have been killed are utilised as game scouts and their job is to move about in couples trying to locate areas where game is congregated, the pair bringing in reliable information getting a leg of any animal bagged especially

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for themselves, plus a little extra *bakshis* in the case of a good head or a bison. A considerable amount of foot-slogging and futile wandering around the jungles is avoided by the shikari in this way. Should tiger be the desired object, unnecessary firing near the kills should be avoided. In fact the sportsman should not pull trigger unless a fine stag or other animal is involved; any thing approaching a drive for game or *jungli moorghi*, with attendant noise and firing will drive all the tigers out of the block miles away. From being so consistently hunted, in the Central Provinces tiger have, I think, developed a high degree of self-protection complex in addition to their natural instincts.

The best months for general shooting are from November to March; not only is the weather delightful, but all game is in hard horn and tiger in their winter coats with well developed neck ruffs on the older animals. Hot weather shooting is easier as regards beating and locating tiger, but a hot weather skin cannot compare with a cold weather one, and besides all game excepting spotted deer have shed their horns.

Always take a camera with you and many pleasant moments can be re-lived again when tied down to the daily grind. If you are a photo fiend there may be some excellent chances to obtain interesting Natural History snaps. Special permission is necessary to operate a flashlight outfit. Take notes and measurements of all game obtained, and also jot down the result of your observations, successful attempts or failures etc., with what you consider contributing factors. In this way you learn a lot and can correct future mistakes made by your jungli assistants. Information from these is often valuable and interesting, but requires careful dissecting to separate the actual from the imaginary.

Lastly a knowledge of colloquial Hindustani is invaluable.

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NOTES ON SOME INDIAN BIRDS.

BY

E. H. N. LOWTHER, M.B.O.U., F.Z.S.

(*With* 6 *plates*).

I.—THE INDIAN CRESTED SWIFT.

It is not unnatural that the student having learnt something of the Bird-life of a country should set his heart on making the acquaintance in the field of a particular species. What is strange, however, is that the bird he is so anxious to study almost invariably is not to be found in the district where he resides. Such precisely was the case with two bird-lovers of my acquaintance; the one had always wished to meet the Racket-tailed Drongo in its forest home, the other a Great Indian Hornbill. Both had spent years in India without seeing the objects of their curiosity, and both were certain to be unable to gratify their wishes so long as they continued to reside in those particular parts. It was just the same in my own case. Constant perusal of Hume's *Nests and Eggs* and the Bird volumes of the *Fauna* attracted me specially to the Crested Swift and the Masked Finfoot. The latter, of course, I shall never see in the wild state unless I visit certain favoured localities in Assam or Burma, but there was no reason why some day I should not have an opportunity of studying the Crested Swift at home. As ill-luck would have it the first twenty-two years of my service were spent in places where this species is not to be found, and, it was not till 1933, when posted to Dhanbad in the Manbhum District, that I was able to make the acquaintance of the Crested Swift. When I saw these charming and graceful birds in the neighbouring district of Hazaribagh, I knew that with any luck I should also find them in the hills round the Topchanchi reservoir, or in the neighbourhood of Gomoh —localities easily accessible from my home and both in my own district. Just possibly too I might happen on a nest. Accordingly, the next two or three occasions I was out after birds I was constantly scanning the skies in the hope of seeing a Crested Swift. Many a time a distant speck which I thought might be this bird turned out to be some other species; often in my anxiety to locate it I mistook the cry of a paroquet for that of the Crested Swift. Eventually, however, in the Sikda Pahar *nala*, where this debouches into rice fields, I spotted half a dozen Crested Swifts flying overhead hawking for insects and occasionally settling on some *simal*, *mhowa* or *dhoka* trees, once on a tree on which, lower down, a Franklin's Nightjar was resting lengthwise.

Returning to the spot on the 2nd July I watched those Crested Swifts for nearly three hours, following them carefully with the

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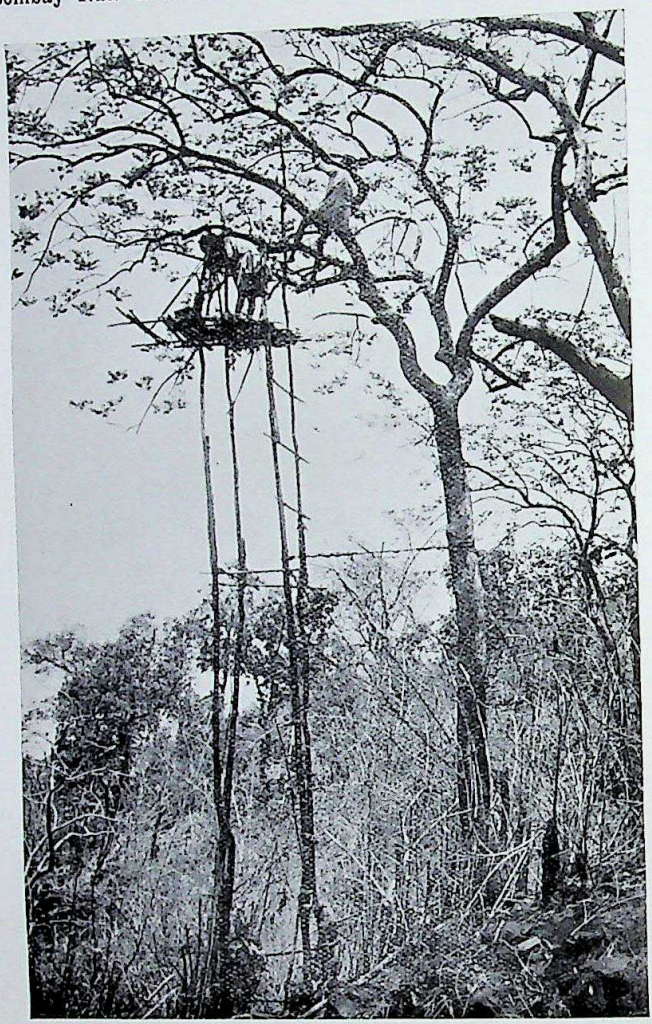
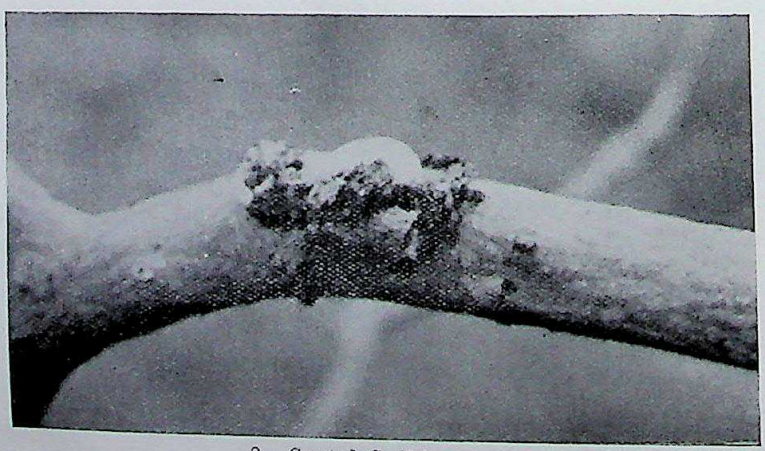


1. Machan from which the first Crested Swift was photographed, 1936. The bird can be seen seated on the nest.



2. Crested Swift's nest.

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glasses in case any of them were still nesting, although fully aware that their normal breeding season was now well over. Repeated inspection of trees on which the birds perched revealed nothing. It was obvious they were only resting. I had almost given up all idea of finding a nest of this species when I saw one of the birds settle on a *dhoka* tree higher up the hill side than had been the case with the others, and consequently in thicker jungle. To this I toiled, expecting to draw the usual blank. To my amazement, however, there was the Crested Swift sitting on what close inspection proved to be a nest. To say I was delighted gives no idea of my feelings. To begin with, the species is very local and the nest one of the most difficult to find, so much so, that I had always imagined—why I know not—that it was never to be my good fortune to see a Crested Swift's nest *in situ*. In the same way as a boy, I had felt that the Red-necked Phalarope's nest and eggs were not to be found by the likes of me. (I may say I later found four nests containing eggs of this rarity when in the Hebrides during the summer of 1914.) Added to all this, it was very late for the Crested Swift to be still nesting, the usual breeding season being during April and May.

As I gazed at the bird seated on her tiny nest only twelve feet up from the ground, I feared I should burst with happiness. I felt I had reached the topmost rung of my hopes, and, that having photographed the bird at home, I could retire gracefully from camera-nesting operations in India. So bold was she that I was able to stand within seven feet of her. She made such a beautiful picture that I determined there and then that if ever I wrote a book about Indian birds her photograph should form the frontispiece to the work.

It was too late to erect a *machan* that evening, but this was done the following day by my *shikari*, who later reported that throughout the two hours he took in building the scaffolding, securing the platform near the top, and fixing on it the hiding tent thrown over a rough tripod, the Crested Swift never once left the nest, although for some considerable time he was standing within five feet of her. This augured well for my chances of obtaining photographs so that I went to bed greatly excited and looked forward to the morrow with more than usual anticipation. Instead of the cawings of rooks coming to me in my dreams that night—as they often do—I dreamed of the Crested Swift. All the details of my watchings and great discovery flashed through my subconscious mind again, and—such is the joy of photographing a new and rare species—I even imagined myself showing the Crested Swift slides to a large and appreciative audience!

July 4 broke fine and the Crested Swift was as good as photographed—or so I supposed. Twenty miles by car and a mile on foot took me to the nest on which I was somewhat surprised to see no bird sitting. Concluding that the owners must be away hawking for insects and that one of the pair would soon be back, I commenced to unpack the camera, only to find the Crested Swift's egg lying broken close to the spot where I was kneeling, the contents still quite fresh. What had obviously happened was

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that some inquisitive wight had climbed on to the *machan*, seized the branch on which the nest was built, pulled it towards himself, and after inspecting the contents, released it suddenly so that the egg was catapulted on to the ground some few feet away.

My feelings can be better imagined than described. I need only say here that in all my experiences with a camera this was my greatest disappointment. It seemed to be expecting too much to find a second nest of this species even though both my *shikari* and I now knew exactly what to look for. However, as I was still stationed at Dhanbad the following year, the last week of March found us both concentrating all our efforts on finding another nest. Birds we saw in three widely separate places—several of them—but the wonderful little edifice eluded our best efforts.

Imagining that it might be rather too early to find a nest in these parts I ceased hunting for some days, ordering my *shikari* to keep a constant lookout the while. Eventually he reported on April 4 that he had that morning found a nest containing an egg, but that it was built at a great height from the ground.

A personal visit early the following day confirmed Sakroo's statement—the nest was a good forty-five feet up. I did not like the look of things at all. It was not so much the height that worried me as the fact that below the nest the ground was solid rock, making the erection of a *machan* an impossible matter; while to put up the *hide* in the tree itself was equally out of the question. The only thing to do was to look for yet another nest!

Inspite of previous misgivings, I now entertained great hopes of locating one, as in this *nala* there were three pairs of Crested Swifts. Nevertheless, it seemed as though I was again to be baulked of my prize. True, the *shikari* succeeded in finding another nest in course of construction, but this for some reason the birds never completed. We both looked elsewhere, but without success, and we eventually returned on April 13 to the range of gently-sloping hills, where Sakroo had found the impossible nest on the 4th. We examined the country in a more westerly direction, where numbers of *simal* trees spread their horizontal but leafless branches over thin scrub-jungle and rocky ground—the breeding haunt of at least two pairs of Franklin's Nightjars. Here, after more than an hour's 'glassing' under a terribly hot sun, I traced a Crested Swift to its home, one that was clearly photographable from a *machan*. This I had built the following day, and over it a minion remained to keep watch till darkness set in, as I was anxious to avoid the tragedy of the previous year.

Before proceeding further, perhaps it would be as well if I described the Crested Swift and said something of its nesting arrangements. The bird is about nine and a half inches in length, the general colouring of the upper parts a bluish-grey, the crest much darker, and the wings and tail dark brown, the crest, wing-coverts and tail being in addition glossed with green. The under parts are a light ashy-grey, becoming white on the abdomen and under the tail. The sexes are similarly coloured except that the warm chestnut patch on the sides of the face in the male

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Crested Swift.

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Crested Swift on nest.

Photo by E. H. N. Lowther.

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is replaced by grey in the female. There is also a tinge of chestnut on the edge of the male's chin which is absent in the female. Unquestionably the bird's most striking feature is the crest. This seems always to be carried erect while the Crested Swift is either incubating or brooding but is depressed in flight and also when the parents feed their offspring. It is as often erect as depressed when the bird is resting on some tree but is erected when it calls. When erect it gives the owner a peculiarly jaunty air. In flight the long tail feathers are most prominent. These are either pencil-pointed, giving the Crested Swift a very paroquet-like appearance, or are strongly forked. When at rest, the long tail feathers may either remain together or be slightly apart, as shown in some of the accompanying plates. The bill, of course, is short with a wide gape, and the wings long and scythe-shaped, as is typical in Swifts.

So far as my experience goes—and I have now studied the bird in several places in the Manbhum, Hazaribagh, Ranchi and Palamau Districts—the Crested Swift is to be met with only in fairly well-wooded or scrub-jungle country, where low or moderate-sized hills occur. My remarks, of course, apply to the months of April and May. With the breaking of the monsoon, it would be more correct to describe the jungle as heavy. In those haunts which it favours, the species may be seen in small parties of three, four or even more pairs, wheeling gracefully over the tree-tops in search of gnats and the other minute insects on which it feeds, sometimes even diving through the larger branches in quest of these, and, if there is a tank handy, constantly dipping down to its surface. The flight is much slower than is the case with other Swifts. From time to time, the bird perches on some bough near the top of a favourite tree and devotes much time to its toilet, frequently giving vent to a loud call, *kip-kee-kep*, the middle syllable much emphasised. This note is also uttered freely on the wing, but then consists usually of only two syllables.

Although resident in those districts where it occurs, these Swifts wander considerably in quest of food. A *nala* which the party haunts to-day will quite likely be deserted a fortnight later in favour of some other suitable spot four or five miles distant. This in turn will give way, when the food supply runs short, to yet another timbered hillside; and so on. Always, however, the different members comprising the party seem to return for nesting purposes to what, for brevity's sake, I may call the permanent home.

The nest is a truly wonderful piece of architecture but since no pen-picture I draw can do justice to it I offer no apology for quoting Whistler's description. He says:—

'The nest is a most remarkable structure. It is a very shallow half-saucer composed of thin flakes of bark and a few small feathers gummed together with inspissated saliva on the side of a horizontal branch. The nest is nowhere more than an eighth of an inch in thickness and is at most half an inch deep in the deepest part. The largest outside measurement is 2 in., which is to say, that the nest can be covered by a crown-piece,

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The branch chosen is usually a dead one often at the top of a high tree, but many nests are built much lower down on small trees growing in open scrub-jungle. Viewed from below the nest has all the appearance of a knot and would seldom be detected were it not for the fact that the female returns at frequent intervals to it. The single egg completely fills the nest. The parent bird sits across the nest and the branch to which it is attached so that the latter takes her weight.

The egg is a very elongated oval, obtuse at both ends and with little or no gloss. It is white with a slight greyish-blue tinge. It measures about 0·94 × 0·62 in.'[1]

While Whistler's description of the nest and egg is very accurate, some of the statements he makes cannot pass unchallenged; others need amplifying; and, although the observations that follow are based on an examination of only six nests, I make these for what they are worth in the hope that what I have to say will encourage others to investigate the habits of this interesting species and so help to solve the many problems with regard to its nidification which still require solution.

First of all—how are the strips or flakes of bark with which the nest is constructed obtained? I noted the following after examining my first nest:—'A striking feature of the material used is the precision with which each piece of bark is cut. These are regular and perfect squares and all of approximately equal size.' I have since come to the conclusion that the obtaining of this material is not the difficult matter that it appears to be at first sight. When a Crested Swift begins to nest, the bark of various trees such as the *simal* and *dhoka* is peeling off in small pieces, and as the ends of these flakes invariably curl upwards, it would appear that the Crested Swift experiences no difficulty in tearing them off. The flakes of bark correspond to the tree on which the nest is built, and it is not improbable that the material is obtained from the identical tree which accommodates the nest.

The nest-branch must be a thin one as otherwise the Crested Swift would probably experience difficulty in 'taking off' owing to the great length of its wings. The following are the diameter measurements of three branches at the nest-site:—

(1) 0·72 in. (the 1933 nest).
(2) 1·03 in. (the 1934 nest, on which I first photographed the Crested Swift).
(3) $1\frac{1}{8}$ in. (the first nest found in 1936 and which I sent to the Society on the egg being destroyed).

Not one of these branches was dead; in fact all the six nests which have come under my observation were built on live boughs. Two other nests my *shikari* found, but which I did not have an opportunity of inspecting, were also constructed on living branches. My experiences have, therefore, either been unusual or Whistler —and others—are not correct in stating that a dead bough is usually selected.

As I have given the measurements of branches at the nest-site

[1] *Popular Handbook of Indian Birds*, 2nd edition, p. 277,

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It appeared that he was wearing a cape.

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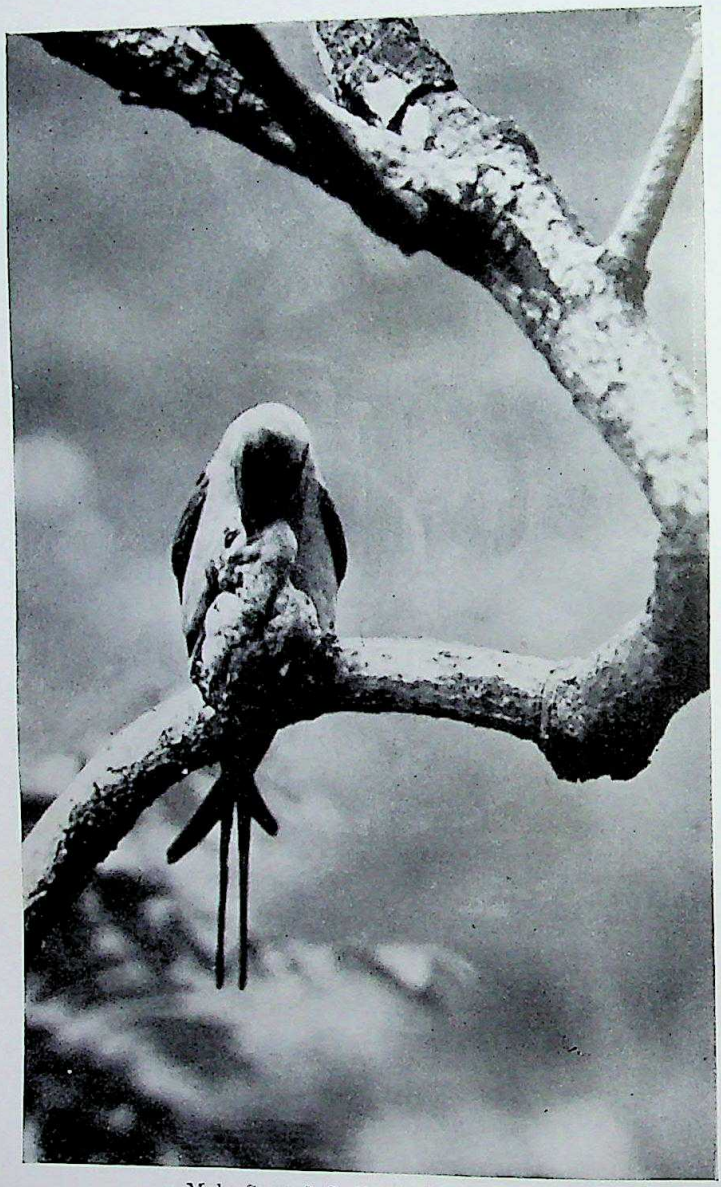

Male Crested Swift feeding young.

Photo by E. H. N. Lowther, 1936.

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it will not be out of place to quote measurements of the nests themselves. These, where obtainable, were:—

(1) 1·75 in. long by $\frac{15}{16}$ in. wide.

(2) $1\frac{10}{16}$ in. long by $\frac{3}{4}$ in. wide.

I was not in a position to measure the thickness of either of these nests, but Mr. Prater informs me that the nest I forwarded to the Society is 10 mm. thick.

The height of the nest from the ground varies considerably. The lowest were twelve and sixteen feet, others between twenty and thirty feet and the highest about forty-five feet from the ground. It is interesting to note that the third nest I investigated in 1936 was built on the same tree as that on which three years earlier I found my first nest. The trees selected for nesting purposes were the *simal* (Silk Cotton), *dhoka*, *ghar-nim* and another, of which I cannot now remember even the vernacular name.

Is it correct to state that the *frequent* return of the female to the nest gives away its whereabouts? And is it *only* the female that incubates? After watching the Crested Swift for many hours I should say that the female incubates for from forty to sixty minutes and the male from thirty to forty minutes at each sitting. While one is sitting the other is hawking for insects a mile or two away, or possibly further afield, at all events right out of sight, and it does not return to the neighbourhood of the nest until it is time to relieve its mate. After circling round once or twice it either flies directly on to the nest, the relieved bird almost invariably leaving as the other is about to alight, or settles on a neighbouring tree for a few seconds, or even a minute or two, before settling. As the nesting season of the Crested Swift is during the months of April, May and June, the hottest time of the year, when even the most ardent ornithologist requires to gird up his loins to go out into the sun, I do not think it can be stated with any degree of correctness that the *frequent* return of the female—or, for that matter the male—gives away the whereabouts of the nest. It is only the most careful watching of the birds with a pair of field-glasses, and that for a prolonged period, that is likely to bring success in this direction. And when the observer has finally seen a Crested Swift settle on some tree it does not necessarily follow that the bird is incubating. Even if it is, the nest is so small and its construction is such that from below it looks exactly like a knot in a branch, which is indeed what ninety-nine persons out of every one hundred would certainly imagine it to be.

One other point before I proceed to tell of the intimate life of the Crested Swift: Whistler, and for that matter Stuart Baker[1] is entirely wrong in stating that the parent bird sits across the nest and the branch to which it is attached so that the latter takes its weight. The statement might be taken to suggest that this is the *only* position adopted by the bird on the nest. In actual fact a Crested Swift may sit in *any* position when both incubating

[1] *The New Fauna*, vol. iv, p. 355.

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and brooding, although it is correct to say that about 65 per cent of the time is spent sitting in the manner described above. Much time is spent (by both sexes) in sitting on the nest itself, across the branch on to which it is built, or even parallel with it. It is by no means uncommon for a bird that started to brood with its body more or less on the branch and its breast feathers covering the far edge of the nest to end up by facing the branch after occupying almost every conceivable angle in between. I have photographed the bird in every position. It is the same with the young one who, however, spends most of the time sitting parallel with the branch.

I have now photographed three different pairs of Crested Swifts at the nest but for the present let us return to the nest which I found on 13 April 1934. A *machan* was built beside and close to it the following day, and since the bird showed no fear, the *hide*, with a bottle protruding through the cloth, was introduced at the same time and remained in position overnight. I spent the whole of the 15th observing and photographing the birds, visiting the nest again for the same purpose on 20 April, 3, 6, 14, 25, 27 May and 1 June. During this time our acquaintance quickly ripened till, in the end, the parent birds fed the young regularly while I was seated beside the hiding-tent fully exposed to their view. On 20 April, however, the behaviour of the female was extraordinary. Just to see to what lengths I could go with the bird I slowly put my hand out towards her until I actually found myself passing my index finger through the feathers of her back, head and breast, tickling her really. She did not move a muscle, but when I put my little finger close to her beak she seized and shook it vigorously. No attempt did the bird make to leave the nest or even to alter her position on it. How I wished some friend might turn up to see us hob-nobbing in this extraordinary manner, to record by means of a camera the boldness shown by this brave heart in sticking to her post. It is interesting to relate that later (1 June) I handled the almost full-grown daughter (as I like to think she was) in exactly the same way and that she too shook my little finger as her mother had done before although (like mother) she did not object in the least to being tickled.

But to return: I had not been two minutes in the *hide* when the Crested Swift was back on the nest. What a beautiful picture she made as she sat there, bolt upright, only a few feet away from me, her pouting breast feathers covering almost half her tiny nest. With her gaze partially averted from me, she seemed confident that no living creature could possibly mean her any harm; and why have any fear for such an inanimate object as a *hide*? In my anxiety to make hay while the sun shone, so to speak, I took a number of photos of the bird, and then realising that the stance in each case was just the same, crawled out of the tent expecting the bird immediately to take flight, she remained on the nest perfectly immobile! Were all birds so easy to photograph at home as in this species, the sport simply would not be worthwhile. But more often than not the odds are against the

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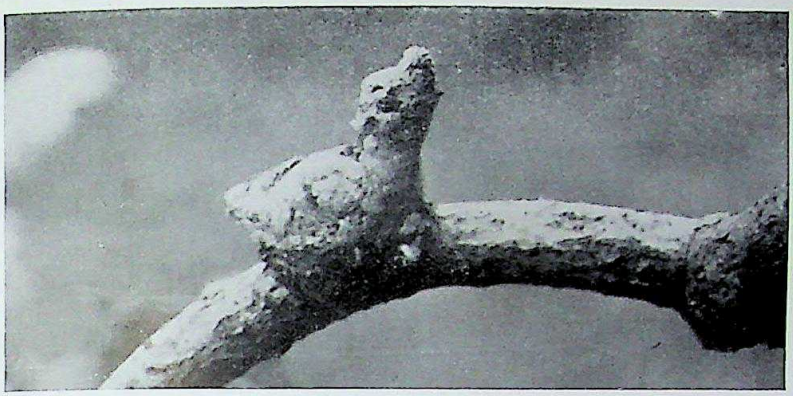

2. Half-grown Crested Swift.

Crested Swift brooding.

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photographer! As I exposed plate after plate on the bird, merely changing the stop or altering the exposure, my thoughts flew back to a Jungle Crow which I had tried to photograph at the nest and to a Water Rail in Kashmir whose picture I obtained after four days of patient trying. It is subjects such as these that make one appreciate more than ever the accommodating nonchalance of the Crested Swift. The actual photography may be easy but one has only to reflect to realise how great has been one's fortune for, not only is the finding of the nest no simple matter but to get close enough to photograph the Crested Swift at home is fraught with obstacles sufficiently formidable to deter all but the keenest devotees of the camera.

Having obtained all the photographs I could take I devoted the rest of the day to observing the birds. In this particular instance the female was the more confiding, the male refusing to come to the nest while I was on the *machan* exposed to his gaze. When, however, I remained concealed, or sat quietly near the tree, he displayed no reluctance, and although ready to leave the nest when I climbed the tree again, he sat sufficiently close to allow me to photograph him. The female's temperament was very different; she literally had to be *pushed* off so that I could inspect the nest and egg carefully. It was then I noted that the wall of the nest was a quarter of an inch or so higher than the upper surface of the branch and extended right on to the branch the flakes of the bark forming an almost complete oval. Such an arrangement undoubtedly helps to prevent the young bird from falling out of the nest. This wall was common to all the nests which I inspected.

It is not always the female who is the more confiding. In the case of the first pair I photographed in 1936, the female was far bolder during the incubation period, but after the egg hatched she would seldom venture to the nest while I was on the *machan*, whereas the male who previously never quite trusted me now was every bit as bold as his mate had been previously—more so in fact. Both had literally and truly to be *pushed* off the nest to enable me to see the egg or young. It was just the reverse with the second pair I photographed in the same year. The male sat closely when incubating, when the female would not venture to the nest while the camera's cold eye stared at her. When the egg had hatched the positions were completely reversed. They too let me touch them and seized my finger when placed near their beaks. As in the case of the other Crested Swifts I had previously photographed it was almost impossible to dislodge this pair from the nest; it is no exaggeration to say that they had to be *removed* from it.

During the first fortnight of its life the young Crested Swift is seldom left unattended by its parents; one broods while the other is absent looking for food. As the latter arrives the first leaves the nest. When this 'change-over' is taking place, when the young bird is aware that it is going to be fed, its behaviour is most peculiar—it sinks down gradually into the nest as though it were going to be courted, much in the same way that pigeons behave,

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Then the parent bird throws its head up with the beak pointing to the skies and looks as though it were going to expectorate; actually the bird is bringing up food. It is only when this movement takes place that the young one holds up its head, the parent putting its beak inside the young one's to feed it. This feeding lasts for about one second only and is accompanied by a minimum of movement and no calling on the part of either parent or child, the latter subsequently sheltering close to or under the adult bird's body. Although what the youngster received always seemed to me to be a thoroughly inadequate meal never did I see it receive food a second time in the same visit, nor by voice or deed did it suggest that it wanted more. On an average it was fed every twenty or twenty-five minutes.

Between the age of two and three weeks the crest becomes prominent in the young and its plumage takes on an ashy-grey colour, with dark-brown patches by the base of the crest, near the eye and on the wings so that the nest and young bird assimilate with their surroundings in a remarkable manner. A week later the general colouring of the plumage is a 'pepper and salt', this pattern making it even more difficult to distinguish the young Crested Swift from its surroundings. I was not surprised therefore to note that at this stage the parents no longer brooded except when it rained or a high wind was blowing. On such occasions the young one caused the male bird considerable uneasiness by the way in which it kept turning round from side to side or stretching its baby pinions. More than once it seemed as though the parent would be knocked off the nest. When, however, the young bird remained quiet for a few seconds the male would puff out his breast and side feathers until it appeared that he was wearing a cape.

Such has been my last glimpse of the three-quarters grown Crested Swift and its parent at three different nests as I packed up camera and tripod and then supervised the dismantling of the *machan*. It is not difficult to enter into the feelings of the egg-collector when he has found and taken the nest and egg of a Crested Swift. I am sure, however, that he will be the first to admit the infinitely greater happiness and pride of the camera-man who has refrained from even touching the egg and has in the fulness of time reaped his reward in observing the young bird grow up, noted the home life of the species and finally secured a large series of photographs to remind him always of pleasant days spent with 'good companions'.

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THE NESTING OF THE INDIAN CRESTED SWIFT (*HEMIPROCNE CORONATA*) IN UPPER BURMA.

BY

J. K. Stanford, I.C.S. and H. C. Smith, I.F.S.

On March 28, 1936, we found in the Pidaung Game Sanctuary of the Myitkyina District a nest of *Hemiprocne coronata* which offered remarkable opportunities for photography. The nest was in a small and almost leafless *Lettok* tree (*Holarrhena antidysenterica*) growing on a grassy plain, and was situated at a height of about 20 ft. from the ground. But for seeing the bird sitting the nest could hardly have been detected from below. The bird was remarkably tame and allowed us to walk under the nest and observe it at very close range, so on the 29th H. C. Smith stalked it with a camera and spent over an hour photographing it from the ground with a 17-inch Teleros lens in a Soho Reflex camera set up on a stand. After the first half hour, the bird refused to leave the nest and sat motionless except for turning its head and erecting its crest when anyone came too close under the branch. As is well known, the Indian Crested Swift incubates while perching upright on a branch with the body and tail on the far side from the nest and the breast feathers projected over the egg. Perched thus with the long wings crossed, and the narrow tail dependent between them, the bird presented a most unique and beautiful appearance as its chestnut-red cheeks and ashy-grey underplumage gleamed in the sun. From the level of the nest, the egg appeared to project well over the shallow rim of the saucer-like structure. We examined the nest after the young one had departed and it measured 47 × 30 mm. and at its centre was 11 mm. in depth. It was composed almost entirely of scales or flakes of bark gummed together with saliva in such a way that the outer layers overlapped somewhat after the manner of the scales of a fircone. The nest was attached to the eastern side of the branch which at that point measured roughly 50 mm. in circumference and was growing horizontally from north to south; the sitting bird therefore had its back to the afternoon sun. The nest was so shallow that presumably the egg would have been blown out unless covered by the bird during the sudden gales which sweep this district at all seasons of the year. The male spent most of the time sitting on a tree nearby and we considered that he took part in incubation. When together, the two were easily distinguishable by the deeper colour of the cheeks in the male and this was very noticeable on one occasion when the sitting bird was observed.

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On April 26, J. K. Stanford re-visited the nest on two occasions with Major Byrne and a game keeper. The young bird was well feathered and sitting like the adult, more or less upright with head and neck extended, crest raised and beak pointing slightly skywards. The colouration, shape and attitude were so extraordinarily protective that the game keeper declined to believe it was a bird at all and had to climb the tree to satisfy himself. (Even his companions had some doubt at first although they were using Zeiss glasses at a range of about 25-30 ft.!) On the first occasion the nestling was sitting on the nest, parallel with the branch, later in the afternoon it was sitting across the branch, so that the short tail was just visible on the other side of the branch from the nest. The shape of the head and drawn-out appearance of the neck were most remarkable and the youngster appeared much more like a chameleon than a bird. The outline of the crown behind the crest seemed to form almost a straight line slanting to a point at the nape.

On April 29, J. K. Stanford again visited the nest with Major Byrne and Mr. D. P. Lister, B.F.S. Kodak photography without a telephoto lens proved a failure and after several attempts Mr. Lister produced a sketch which shows clearly the remarkable similarity of the young bird to a Nightjar. (This, we may say is well-illustrated by one of the photographs reproduced in Mr. H. Whistler's article on the nesting of the Crested Swifts in volume xxxiv of the Society's *Journal*, page 772.) The shape of the young bird's head had by that time altered considerably, but we all agreed that it bore no resemblance whatever to the shape of the head in the adults, which we could observe at a few yards' range as they sat on a tree nearby. The chameleon-like appearance was still most pronounced, and the young bird sat like a Nightjar along the branch with head and neck raised, beak pointing upwards and gape slightly open. In this phase of juvenile plumage, the mottled colouring also suggests a Nightjar much more strongly than a Swift.

The crest plumes, as far as could be seen with glasses at very close range, were in quill and quite stiff, in profile each feather being sharply divided from the next.

This bird was last seen on May 2nd, still on the branch but no longer on the nest; it had disappeared next day.

Photographs of the young being fed in its later stages of development would be of very great interest, and, judging by our experience in this case, should not be difficult to obtain.

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THE MEDICINAL AND POISONOUS AROIDS OF INDIA.

BY

J. F. CAIUS, S.J., F.L.S.

The ARACEAE include about 107 genera with over 1,000 species, most of which are natives of tropical regions and the rest of temperate regions, in both hemispheres. Most of them contain an acrid juice, which is sometimes highly irritating and poisonous.

The medicinal and poisonous Aroids of the world belong to 42 genera:—ACORUS (northern temperate regions, South-Eastern Asia); AGLAONEMA (Tropical Asia and Africa); ALOCASIA (Tropical Asia); AMORPHOPHALLUS (Tropical Asia and Africa); ANADENDRUM (Malaya); ANCHOMANES (Tropical Africa); ANTHURIUM (West Indies, Central and Southern America); ARISAEMA (Asia, Abyssinia, America); ARISARUM (Mediterranean region); ARUM (Europe, Northern Africa, Western Asia); BIARUM (Asia Minor, Syria, Northern Africa); CALADIUM (South America, Indo-Malaya); CALLA (Europe, Northern Asia and America, Philippine Islands); COLOCASIA (Tropical Asia); CRYPTOCORYNE (Indo-Malaya); CULCASIA (Tropical Africa); DIEFFENBACHIA (Central and South America, Japan); DRACONTIUM (South America, Java); DRACUNCULUS (South Europe, Canary Islands); EPIPREMNUM (Malaya, Polynesia); HOMALOMENA (Asia, South America); LAGENANDRA (India, Ceylon); LASIA (Indo-Malaya); MONSTERA (Tropical America); MONTRICHARDIA (Tropical America); ORONTIUM (Northern America); PHILODENDRON (Tropical America); PINELLIA (China, Japan); PISTIA (Tropics and subtropics except Polynesia and Macronesia); PLESMONIUM (India); POTHOS (Indo-Malaya, Madagascar); REMUSATIA (Tropical Africa, Indo-Malaya); RHAPHIDOPHORA (Indo-Malaya); RICHARDIA (Southern Africa); SAUROMATUM (palaeotropics); SCINDAPSUS (Indo-Malaya); STYLOCHITON (Tropical and Southern Africa); SYMPLOCARPUS (Northern America); SYNANTHERIAS (Southern India, Ceylon); TYPHONIUM (Indo-Malaya); TYPHONODORUM (Madagascar); XANTHOSOMA (West Indies, Tropical America).

The medicinal and poisonous Aroids of India belong to 21 genera:—ACORUS, AGLAONEMA, ALOCASIA, AMORPHOPHALLUS, ANADENDRUM, ARISAEMA, COLOCASIA, CRYPTOCORYNE, EPIPREMNUM, HOMALOMENA, LAGENANDRA, LASIA, PISTIA, PLESMONIUM, POTHOS, REMUSATIA, RHAPHIDOPHORA, SAUROMATUM, SCINDAPSUS, SYNANTHERIAS, TYPHONIUM.

I. Spadix with or without an appendage.
  A. Leaves entire or lobed. Stamens free; ovary 1-celled; ovules orthotropous.
    1. Spadix appendaged.
      a. Marsh herbs. Ovaries spirally disposed ... LAGENANDRA.
      b. Terrestrial tuberous herbs.
        i. Leaves compressed, lobed ... ... ARISAEMA.
        ii. Leaves pedatipartite, appearing after the flowering ... ... SAUROMATUM.
        iii. Leaves ovate or lobed, coetaneous with the flowers ... ... TYPHONIUM.

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2. Spadix without an appendage.
   a. Floating stemless herb; leaves obovate ... PISTIA.
   b. Submerged or aquatic herbs; leaves ovate or lanceolate ... ... CRYPTOCORYNE.

B. Tuberous herbs large. Leaves appearing without flowers, solitary, very large, 3-lobed or pinnatisect. Ovules anatropous.
1. Spadix without an appendage; neuters very large PLESMONIUM.
2. Spadix appendaged.
   a. Appendage large, naked; neuters absent ... AMORPHOPHALLUS.
   b. Appendage slender, naked; neuters below the male ... ... SYNANTHERIAS.

C. Herbs not tuberous; stem creeping, erect or subterranean. Leaves undivided, cordate or peltate.
1. Limb of spathe refracted, open; ovules parietal. REMUSATIA.
2. Limb of spathe erect.
   a. Ovules many, parietal; fruit subcapsular ... COLOCASIA.
   b. Ovules few, basal; fruit drupaceous, red ... ALOCASIA.

II. Spadix without an appendage.
A. Flowers monoecious. Perennial herbs, flowering and leafing at the same time. Spadix shorter than the spathe. Fruit enclosed in the spathe tube.
1. Spathe eventually deciduous; fruit a red drupe. AGLAONEMA.
2. Spathe persistent; fruits very small, not drupaceous or red ... ... HOMALOMENA.

B. Flowers bisexual.
1. Climbers often woody.
   a. Perianth none, or a thin semicircular limb.
      i. Drupes distinct, red ... ... ANADENDRUM.
      ii. Fruits crowded, not drupaceous or red.
         ¶ Ovary 1-celled, 1-seeded. Leaves ovate to oblong-lanceolate entire ... ... SCINDAPSUS.
         ¶¶ Ovary 1-2-celled, many-ovuled. Berries confluent. Seeds oblong ... ... RHAPHIDOPHORA.
         ¶¶¶ Ovary 1-celled, 1-seeded. Leaves entire or lobed. Seeds kidney-shaped ... ... EPIPREMNUM.
   b. Perianth lobes 6. Spadix flowering upwards. Leaves distichous ... ... POTHOS.
2. Large marsh plant with stout stem, prickly erect. Spadix, much shorter than the long spathe, flowering downwards, sessile. Leaves lobed. LASIA.
3. Stemless rhizomatous plant; rhizome aromatic. Leaves ensiform. Spathe none ... ... ACORUS.

ACORUS.

The genus consists of 2 species, inhabiting the northern temperate regions and South-Eastern Asia.

A. calamus Linn. is used medicinally in India, Malaya, Indo-China, China, Europe and South Africa; *A. gramineus* Soland in Malaya, Indo-China and China.

Midrib of leaves stout ... ... 1. *A. calamus*.
Midrib of leaves absent ... ... 2. *A. gramineus*.

1. Acorus calamus Linn. is found throughout India and Ceylon, in marshes, wild or cultivated, ascending the Himalaya up to 6,000 ft. in Sikkim. It occurs in all European countries except Spain, and becomes more abundant eastwards and in Southern Russia, Northern Asia Minor and Southern Siberia, China and Japan, Indo-China and Malaya. It is also met with in the

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Northern United States of America, where it appears to be indigenous.

The rhizome is described in the Nighantas as pungent, bitter, heating; emetic, laxative, diuretic, carminative, anthelmintic; improves appetite, voice, throat; good for diseases of the mouth; useful in abdominal pains, inflammations, fevers, epilepsy, bronchitis, delirium, hysteria, dysentery, tumours, thirst, loss of memory, rat-bite, worms in the ear.

According to Mahommedan writers the rhizome has a very bitter sharp taste; it is laxative, expectorant, carminative, alexiteric, tonic to the brain, emmenagogue; useful in general weakness, stomatitis, toothache, inflammations, pains in the liver and the chest, kidney troubles, leucoderma.

The aromatic rhizome or rootstock is considered emetic in large doses, and stomachic and carminative in smaller doses. It is a simple useful remedy for flatulence, colic or dyspepsia, and a pleasant adjunct to tonic or purgative medicines. It is also used in remittent fevers and ague by the native doctors, and is held in high esteem as an insectifuge, especially for fleas.

The root has been employed in medicine since the time of Hippocrates. By the moderns it is successfully used in intermittent fevers, even after Cinchona bark has failed, and it is certainly a very useful addition to Cinchona. It is also a useful adjunct to bitter and stomachic infusions.

It is commonly used to allay distressing cough. A small piece of the dried rootstock kept in the mouth acts better than many cough lozenges. It produces a warm sensation in the mouth and a beneficial flow of saliva. The candied root is sold as a favourite medicine in every Indian bazaar. The Indians of the Hudson's Bay Territory also use the rootstock as a cough medicine.

The Mundas of Chota Nagpur apply the ground rhizomes to the cranial suture of feverish babies.

In Ceylon the rootstock is used in bowel complaints. It has been found extremely useful in the dysentery of children, and also in bronchitic affections. The Europeans of South Africa use it as a carminative and as a diarrhoea remedy.

The Meskwaki Indians of Wisconsin use it as a physic, and in combination with other medicines as a cure for burns, while the Menomini give it for cramps in the stomach.

The root is supposed by the Chinese to affect the heart and lungs and to be beneficial for cancer. In general it is taken as a restorative for the body and spirits.

Culpeper says: 'The spicy bitterness of the root of this plant bespeaks it as a strengthener of the stomach and head, and therefore may fitly be put into any composition of that intention. The root preserved may with good success be used by itself, and both the Germans and Turks are very fond of it, and reckon it a great preservative against infectious air, which makes them commonly eat a piece of the preserved root fasting.'

Even nowadays the candied rhizome is widely employed in Europe, and the Turks use it as a preservative against contagion.

Moodeen Sheriff experimented with the drug and wrote: 'The

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rhizome is emetic, nauseant, antispasmodic, carminative, stimulant and insecticide. As an emetic it is more nauseant and depressant than Ipecacuanha, and it is therefore useful in most of the diseases in which the latter is indicated, including dysentery. It is one of the two vegetable drugs in this country which act efficiently as emetics in so small a dose as 30 grains. It should not be used in more than 35 grains, and in 40 grains its action is very violent and obstinate. It is a good remedy in asthma, to relieve which, it should be first used in pretty large or nauseant doses (15 to 20 grains) and then repeated every 2 or 3 hours in smaller or expectorant doses (10 grains) till relieved. Among other diseases which are most benefited by this drug are bronchial catarrh, hysteria, neuralgia and some forms of dyspepsia. The rhizome can also be used in the form of a tincture or an infusion.'

Later Koman gave a decoction to several patients suffering from indigestion and found it to be efficacious.

The rhizome is officinal in Austria, Germany, Holland, Hungary, Italy, Norway, Portugal, Russia, Sweden and Switzerland.

Caius and Mhaskar have found the rhizome useless for the antidotal treatment of snake bite and scorpion sting.

Afrikaans: Kalmoes—; *Annam*: Thach xuong bo, Xuong bo—; *Arabic*: Vaj, Vash—; *Assam*: Bach—; *Bengal*: Bach, Shwetbach—; *Burma*: Linhe—; *Canarese*: Baje—; *Chinese*: Che Ts'ang Pou, Choui Ts'ang Pou, Pai Ch'ang, Ts'ang P'ou—; *Cutch*: Vekhanda—; *Deccan*: Gandkilakri, Vach—; *Dutch*: Kalmus, Zwanenbrood—; *English*: Bastard Water Flag, Calamus, Cinnamon Sedge, Myrtle Grass, Myrtle Sedge, Sweet Cane, Sweet Flag, Sweet Myrtle, Sweet Root, Sweet Rush—; *French*: Acore, Acore aromatique, Acore odorant, Acoro vrai, Acori, Acrois, Galanga des marais, Roseau aromatique, Roseau odorant—; *German*: Ackermagen, Deutscher Ingber, Gewuerzkalmus, Kalmus, Karmes, Karmsen, Kaumeles, Kolmas, Magenwurz, Nagenwurz, Schiemen, Schienenzurz, Wechel, Zehrwurz—; *Gujerati*: Gandhiloyaj, Godavaj, Vekhand—; *Hindi*: Bach, Ghorbach, Gorbach, Igir, Kussebbewa—; *Italian*: Acoro, Acoro aromatico, Acoro odoroso, Calamo, Calamo aromatico, Canna odorifera, Erba cannella, Erba di Venere, Erba venerea—; *Jhalawan*: Kull—; *Kashmir*: Vahi—; *Malaya*: Cheong fu, Deringu, Jeringu—; *Malayalam*: Vashampa—; *Marathi*: Vekhand—; *Menomini*: Apaxkiu utcipa, Enausapokotcikun, Weke, Wiabiskitcipa kakasapotcikun—; *Meskwaki*: Mishinepisuni—; *Mundari*: Otehajam—; *Norfolk*: Gladdon—; *Norwegian*: Kalmus—; *Pacific Coast*: Beewort, Calamus-root, Flag-root, Myrtle Flag, Sweet Cane, Sweet Cinnamon, Sweet Flag, Sweet Myrtle—; *Pampangan*: Bueng—; *Persian*: Agar, Agreturki—; *Portuguese*: Calamo aromatico, Canna cheirosa—; *Prairie Potawatomi*: Sinipisiwun—; *Punjab*: Bariboj, Wach—; *Roumanian*: Spervian—; *Sanskrit*: Bhadra, Bhutanashini, Bodhaniya, Galani, Golomi, Ikshuparni, Jalaja, Jatila, Kanga, Kshudraptri, Lomasha, Mangalya, Rakshoghni, Shadagrantha, Shataparvika, Schleshmaghni, Smarani, Tikshna, Tikshnapatra, Ugra, Ugragandha, Vacha, Vijaya—; *Sinhalese*: Wadakaha, Wadakahavasambu—; *South Africa*: Myrtle Flag, Sweet Flag, Sweet Sedge—; *Spanish*: Acoro, Acoro verdadero—; *Swedish*: Kalmus—; *Tagalog*: Lubigan—; *Tamil*: Vashambu—; *Telugu*: Vadaja, Vasa, Wasa—; *Urdu*: Bacha—.

2. **Acorus gramineus** Soland occurs in the Sikkim Himalaya up to 6,000 ft., and in the Khasia Hills. It extends to China and Japan.

The root has stimulant, tonic, antispasmodic properties, and is used in China as a diaphoretic, an insectifuge and an insecticide. In Cochin-China it is considered a good substitute for Sweet Flag.

Annam: Thach truong bo—; *Chinese*: Ch'ang P'u, Shih Ch'ang P'u, Shui Ch'ang P'u, Wai Ch'ang P'u—; *Malaya*: Soi cheong phoo—.

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Aglaonema.

The genus includes about 20 species, Tropical Asiatic and African.

Aglaonema angustifolium N. E. Br. var. **undulatum** Ridl. is found in the Malay Peninsula, where the natives use a decoction of the roots for fever and dropsy.

Malay: Penggehe, Sagut, Sumpuh bulau, Sumpuh kring—.

Alocasia.

The genus numbers 45 species, found in Tropical Asia.

A.	Leaves broadly ovate-cordate, repand, nerves 5-6 pairs; petiole short stout	4. *A. montana.*
B.	Leaves large ovate, deeply sagittately cordate, repand; petiole stout, transversely clouded ...	2. *A. indica.*
C.	Leaves triangular-sagittate, shortly acuminate, about $\frac{1}{3}$ as broad as long; petiole long slender ...	1. *A. denudata.*
D.	Leaves broadly ovate-sagittate, repand; basal lobes rounded, connate for $\frac{1}{10}$th of their length; petiole 2-4 ft., base sometimes as thick as the arm ...	3. *A. macrorrhiza.*

1. **Alocasia denudata** Engl. (=*A. singaporensis* Linden) is common in hedges and woods all over the Malay Peninsula, extending to Lingga and Borneo.

The acrid juice is used as a poison in Kelantan.

Malay: Berar kitan, Keladi chandek, Keladi rimau, Keladi ular.

2. **Alocasia indica** Schott is cultivated in India and in most parts of the tropics.

Sanskrit writers describe the rootstock as pungent, fragrant, cooling; useful in inflammations, leprosy, anasarca, diseases of the abdomen and spleen.

Medicinally it is said to be useful in anasarca. The flour obtained by pounding the dried stems boiled with rice flour until all the water has evaporated, is given to the patient, and no other food allowed except milk. The ash, mixed with honey, is used in cases of aphthae.

As a food taken frequently, it seems to act as a mild laxative and diuretic. In piles and habitual constipation it is useful.

The tubers chopped fine, tied in a cloth and heated, are used as a fomentation in rheumatism.

The acrid juice of the petioles is much used as a common domestic remedy on account of its styptic and astringent properties. The petiole is slightly roasted and the juice expressed. Purulent discharge from the ears in children is often stopped by a single application.

The juice of the fresh petiole has no action in the symptomatic treatment of scorpion sting (Caius and Mhaskar).

Assam: Mankachu—; *Bengali*: Manguri, Mankachu—; *Betsimisaraka*: Saombia—; *Canarese*: Manaka—; *English*: Acrid Taro, Giant Taro—; *Fiji*: Dranu, Via—; *Goa*: Curcas—; *Guam*: Piga—; *Hindi*: Mankanda, Mankandu, Mankashu, Manna—; *Malay*: Birah, Keladi sebaring—; *Marathi*: Alu—; *Mundari*: Mansaru—; *Philippines*: Biga, Elephant's Ears—; *Samoa*: Ape,

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Ta'amu—; *Sanskrit*: Brihachhada, Chhatrapatra, Mahapatra, Mana, Manaka, Sthalapadma, Vistirnaparna—; *Sinhalese*: Rata-ala—; *Tagalog*: Badiang, Gabingonac—; *Visayan*: Badiang—.

3. **Alocasia macrorrhiza** Schott is found wild and cultivated throughout tropical and subtropical India. It is cultivated in the tropics generally.

The root is a mild laxative and diuretic.

It is numbered among the recorded fish-poison plants in Australia. The milky juice of the lower part of the stem is used in Queensland as an antidote to the stings of *Laportea gigas* Wedd., the Giant Nettle.

Chinese: Hai Yu—; *English*: Acrid Taro, Giant Taro—; *Easter Island*: Kape—; *Guam*: Piga—; *Hawaii*: Ape, Apü—; *New Caledonia*: Alendiete, Baouen, Diamote, Ouagan, Pera, Taro—; *Philippines*: Biga—; *Queensland*: Banganga, Bargadga, Cunjevoi, Hakkin, Nargan, Pitchu—; *Rarotonga*: Kape—; *Samoa*: Ape, Ta'amu—; *Sinhalese*: Habarala—; *Tahiti*: Ape—.

4. **Alocasia montana** Schott occurs in the Northern Circars, and has been found in Java.

The root is said to be used to poison tigers (Roxburgh).

Amorphophallus.

This genus includes about 90 species, spread over tropical Asia and Africa.

A. rivieri Durieu is used medicinally in China; *A. dracontioides* N. E. Br., *A. flavovirens* N. E. Br., and *A. johnsonii* N. E. Br. are used in the Gold Coast.

Style many times longer than the ovary ...	... 1. *A. campanulatus*.
Style absent	... 2. *A. prainii*.

1. **Amorphophallus campanulatus** (Roxb.) Bl. is largely cultivated throughout the plains of India and Ceylon. It occurs in open pastures, in grassy fields, and on the borders of woods all over the Malay Peninsula, whence it extends to Siam, Sumatra, Java and the Andamans.

Sanskrit writers describe the tuber as dry, acrid, pungent; increasing both appetite and taste; stomachic, constipating; useful in piles, enlargement of the spleen, tumours, asthma, bronchitis, vomiting, abdominal pain, blood diseases, elephantiasis; causes itching sensation; harmful in leprosy, leucoderma. The tuber is covered with a layer of earth, roasted in hot ashes, and administered with the addition of oil and salt. Several confections are also used. The dried tubers, peeled and cut into segments, are sold in the shops.

The corm and the seeds are used as irritants and relieve the pain of rheumatic swellings when applied externally. The corm is considered a hot carminative in the form of a pickle. The tuber contains a large quantity of farinaceous matter, mixed with acrid poisonous juice, which may be extracted by washing or heat. When fresh, it acts as an acrid stimulant and expectorant, and is used in acute rheumatism. It is supposed to have restorative

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powers and is in much request. It is considered serviceable in haemorrhoids.

The root is used in ophthalmia and applied to boils. It is also used as an emmenagogue.

The raw tuber, well ground, is rubbed on swellings of the extremities by the Mundas of Chota Nagpur. If eaten, it produces unbearable itching in the mouth and throat, and it may prove fatal.

Bengal: Ol—; *Bombay*: Janglisuran—; *Burma*: Wa—; *Cagayan*: Bagang—; *Cutch*: Janglisuran—; *Deccan*: Kanda—; *Hasada*: Hada, Hatuhada—; *Hindi*: Kanda, Ol, Zaminkand—; *Ilocano*: Carot, Corot—; *Jolo*: Bagong—; *Kolami*: Ol—; *Konkani*: Suma, Surna—; *Malayalam*: Karunakarang—; *Marathi*: Suran—; *Matheran*: Suran—; *Naguri*: Haluhada, Ol—; *Persian*: Zaminkand—; *Punjab*: Nagphannigand, Zamin gand—; *Sanskrit*: Arsaghna, Arshoghna, Bahukanda, Durnamari, Kanda, Kandala, Kandarha, Kandashurana, Kandi, Kandula, Kandvardhana, Kanthalla, Olla, Rutchyakanda, Sthulakandaka, Sukandi, Suvitra, Tivrakantha, Vatari—; *Tagalog*: Apon, Pungapung, Tocodlangit—; *Tamil*: Karunaikkalang, Karunaikkilhangu—; *Telugu*: Daradakandagadda, Ghemikanda, Kanda, Kandagodda, Manchikanda, Polikanda—; *Uriya*: Olna—; *Visayan*: Anto, Oroy, Pamangguilon, Pungapung, Tocodlangit—.

2. Amorphophallus prainii Hook. fil. is common in the forests of the Malay Peninsula, especially by the forest paths. It extends to Sumatra.

The acrid juice is used as a poison by the Malays. Mixed with *Antiaris* latex it is one of the Sakai dart poisons.

Malay: Sikir, Loki, Lokie—; *Sakai*: Begung—.

Anadendrum.

The genus consists of 4 or 5 Malayan species.

Anadendrum montanum Schott var. **longirostris** Hook. fil. is common in the Malay Peninsula, where it is found in the low country growing low down on tree trunks in thick forest. It extends to Tenasserim, Java and Borneo.

The roots are used medicinally by the Malays.

Malay: Akar asam tebing darat, Akar merayan, Akar sugunja, Akar cumbung—.

Arisaema.

The genus includes 105 species, inhabiting Asia, Abyssinia and America.

A. japonicum Schott, *A. ringens* Schott, *A. thunbergii* Blume are used medicinally in China; *A. thunbergii* Blume is used in Indo-China; *A. triphyllum* Schott in North America.

A. Leaves trifoliolate. Limb of spathe ovate-lanceolate, incurved caudate-acuminate ... ... 2. *A. speciosum*.
B. Leaves pedatisect. Limb of spathe incurved, broadly cymbiform, acuminate ... ... 3. *A. tortuosum*.
C. Leaflets whorled. Limb of spathe suberect, cymbiform, long caudate-acuminate ... ... 1. *A. leschenaultii*.

1. Arisaema leschenaultii Blume is found in the Nilgiris, Travancore and Ceylon.

The roots are used medicinally by the Sinhalese.

Sinhalese: Walkidaran—.

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2. **Arisaema speciosum** Mart. occurs in the temperate Himalaya from Kumaon to Sikkim and Bhutan.

In Hazara, the root is stated to be poisonous; in Chumba, it is applied pounded to snake-bites. In Kulu, where the tuber is given to sheep for colic, the fruit is said to have deleterious effects on the mouth when eaten by children.

The root is not an antidote to snake venom (Mhaskar and Caius).

Punjab: Kiralu, Kirikikukri, Sampkikhumb—; *Sinhalese*: Walkidaran—.

3. **Arisaema tortuosum** Schott is found in the Sikkim Himalaya, Manipur, Bengal and the Western Peninsula.

It is stated to have poisonous qualities. In Kulu, the seeds are said to be given with salt for colic in sheep. The roots are used to kill the worms which infest cattle in the rains.

Kharwar: Dain—; *Nepal*: Birbanka—; *Punjab*: Don, Gurin, Jangosh, Kirakal, Kirkichalu—; *Santali*: Tuyajondra—.

Colocasia.

The genus numbers 7 species, natives of tropical Asia, one of which is cultivated or naturalised in many subtropical countries.

Colocasia esculenta (Linn.) Schott (=*C. antiquorum* Schott) is found wild and cultivated throughout the hotter parts of India and Ceylon. It is cultivated in all hot countries.

The pressed juice of the petioles is styptic, and may be used to arrest arterial haemorrhage. It is sometimes used in earache and otorrhoea, and also as an external stimulant and rubefacient. The juice expressed from the leaf-stalks is used with salt as an absorbent in cases of inflamed glands and buboes. The juice of the corm is used in cases of alopaecia. Internally, it acts as a laxative, and is used in cases of piles and congestion of the portal system, also as an antidote to the stings of wasps and other insects. The tubers chopped fine, tied in a cloth and heated, are used as a fomentation in rheumatism.

The corm is used by the Mundas as a remedy for body-ache.

Caius and Mhaskar have demonstrated that the juice of the corm is without action in the symptomatic treatment of scorpion sting.

Accra: Mankani—; *Angami Naga*: Dzu, Kirth—; *Annam*: Khoai nuoc—; *Arabic*: Kalkas, Kur, Gulgas—; *Ashanti*: Kooko—; *Bengal*: Ashukuchu, Bunkuchu, Charkuchu, Guri, Kachhu, Kachu, Kalokuchu, Kuchu—; *Bombay*: Kachualu, Terem—; *Brazil*: Tayoba de São Thome—; *Burma*: Mahuyapein—; *Cagayan*: Gabi—; *Canarese*: Kesavedantu, Keshavanagadde, Shamegadde—; *Carolines*: Chaua—; *Chinese*: Yu, Yu T'eou—; *Cuba*: Malanga—; *Deccan*: Arvi, Chamkurekagaddah—; *Egypt*: Culcas, Kolkus, Golkas—; *English*: China Potato, Coco, Coco Yam, Eddoes, Egyptian Arum, Kopeh, Scratch Coco, Taro—; *Fanti*: Kooko, Mankani—; *Fiji*: Taro—; *French*: Chou caraïbe, Colocase, Colocasie, Gingembre d'Egypte—; *Fufulde*: Tandauje—; *Gold Coast*: Coco Yam—; *Guam*: Sune, Suni—; *Hausa*: Gwaza, Kamu, Koko yam—; *Hindi*: Arvi, Arwi, Ashukachu, Auri, Avois, Gagli, Ghoya, Ghuian, Ghuiya, Ghuya, Ghwiya, Gorikachu, Kachalu, Kachalu arvi, Kachu—; *Japanese*: Aka-imo, Imo, Midsu-imo, To-no-imo—; *Kangra*: Arbi, Gandiali, Kachalu—; *Khasi*: Ka shiriw—; *Kolami*: Pichgisaru—; *Konkani*: Allum—; *Languedoc*;

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Farrao—; *Le Reunion*: Songe, Songe du pays, Sonze de Chine, Sonze de Maurice, Sonze noire, Sonze du pays—; *Lynngam*: Chew—; *Madagascar*: Songe—; *Malay*: Keladi china, Keladi hudang, Keladi telor—; *Malayalam*: Chempakizhanna, Kaladi—; *Malta*: Coco, Cocoaroot, Colocasia, Aro di Egitto, Ghorghas—; *Marathi*: Alu—; *Marquesas*: Tao—; *Mexico*: Quequexquic, Quequeste—; *Mundari*: Birsaru, Kucusaru—; *New Caledonia*: Barenik, Coboué, Dadi, Diali, Diamboilaté, Doboua, Jabouak, Jalapé, Kandié, Kandiéren, Kavé, Kiamoan, Néré, Ouagapé, Ouaoua, Oumon, Ounégaté, Paricraouté, Pobo, Tanmaouté, Taro, Tianaboué, Tiaouné, Tiréné—; *Pampangan*: Gabi, Gandus, Gavay, Lagway—; *Panama*: Oto—; *Philippines*: Badiang, Dagmay—; *Polynesia*: Kalo, Talo, Taro—; *Porto-Rico*: Yautia malanga—; *Punjab*: Alu, Gagli, Ghuyan, Givian, Kachalu, Kachalu arbi, Kasauri, Rab—; *Sadani*: Bonsaru—; *Sanskrit*: Kachchi, Kachu, Kachwi—; *Sema Naga*: A'i—; *Singapore*: Gahala, Tadala—; *Sinhalese*: Gahala, Habarala, Kandala, Tadala—; *South Carolina*: Carib Cabbage—; *Spanish*: Aro de Egipto, Name de Canarias, Name de Egipto, Yame de Canarias, Yame de Egipto—; *Sunda*: Talas, Taloes—; *Tagalog*: Gabi, Gabingpola, Gabingsilangan, Gabynasiboyas, Gabynasiniboyas, Gandus, Gavay, Lagvay—; *Tamil*: Shamakkilangu, Shemakkalenga—; *Telugu*: Chamadumpa, Chamagadda, Chamakura, Chamakuru, Chema, Shamathumpa—; *Twi*: Kooko—; *Uriya*: Saru—; *Visayan*: Abalong, Apipi, Biga, Dagmayngaapipi, Dagmayngabolilao, Dafimayngainitlog, Dagmayngaquinson, Dagmayngatapol, Gabi, Gabingmorada, Ganyngaguinatos, Galiang, Gandus, Gavay, Guinatos, Lagway, Quimpoy—; *West Africa*: Coco Yam—; *West Indies*: Coco, Eddo, Eddoes, Dasheen, Tania, Tanier—; *Yoruba*: Koko—.

Cryptocoryne.

The genus consists of 40 Indo-Malayan species.

Cryptocoryne spiralis Fisch occurs from Khandesh to North Kanara, Calicut, Coromandel, Ceylon and Bengal.

It is a well-known drug in Ceylon, where it is employed by the native doctors in decoctions, in combination with other drugs as a remedy for infantile vomiting and cough, and in the case of adults for abdominal complaints and fever.

The plant is considered a substitute for Ipecacuanha. It contains neither emetine nor cephaeline (Chopra).

Tamil: Nattativadayam—; *Telugu*: Nattativasa—.

Epipremnum.

The genus consists of 14 Malayan and Polynesian species.

Leaves very large entire	... 1. *E. giganteum*.
Leaves deeply cut into acuminate lobes ...	... 2. *E. mirabile*.

1. **Epipremnum giganteum** Schott is common on rocks and trees in the Malay Peninsula, whence it spreads over to Siam and Cochin-China.

The powdered spadices are used to mix with the dart poison by some of the Sakai tribes.

Malay: Rengut, Ringhut, Ringut—.

2. **Epipremnum mirabile** Schott is found in Martaban, Tenasserim, China, the whole of Malaya, Australia and Polynesia.

The plant is said to have anthelmintic properties,

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Homalomena.

The genus includes 30 Indo-Malayan and tropical American species.

A. Spathes red ... ... 3. *H. rubescens.*
B. Spathes green.
a. Spathe 3 in. oblong, acute at base and top. Basal lobes of leaves divaricate ... ... 1. *H. aromatica.*
b. Spathe 1-1¼ in. linear-oblong. Base of leaves rounded ... ... 2. *H. ovata.*

1. Homalomena aromatica Schott is found in Assam and Chittagong.

The large rhizome, which is invested with the old withered leaf-scales, bears numerous white long rootlets issuing from its surface, and is said to be held in high estimation by the natives as an aromatic stimulant.

Bengal: Kuchugundubi—.

2. Homalomena ovata Hook. fil. is found in Bukit, Timah and Singapore, whence it extends to Borneo.

The plant is used medicinally by the Malays.

Malay: Asam tikus, Kelamoyiang, Kumayan, Kumayan Jantan—.

3. Homalomena rubescens Kunth. is found in the Sikkim Himalaya, the Khasia Hills and Chittagong, extending to Java.

The plant is used as a poison by the Malays. It enters into the composition of 'ipoh' and is thrown into rivers to poison the water.

Lagenandra.

The genus consists of 5 species, spread over India and Ceylon.

Lagenandra ovata (Linn.) Thwaites (=*L. toxicaria* Dalz.) is a marsh plant occurring from the Konkan to North Kanara, Mysore, Coorg, Cochin, Travancore, and Ceylon where it is common in the Central Provinces.

The plant is said to have insecticidal properties. It is considered very poisonous in Southern India.

Southern Konkan: Vatsanabh—.

Lasia.

The genus consists of 3 Indo-Malayan species.

Lasia aculeata Lour. (=*L. heterophylla* Schott) is a stout spinous marsh plant occurring from tropical Sikkim Himalaya, Assam, Bengal and Burma, southwards to Ceylon and the Malay Peninsula, and extending to the Malay Islands and China.

The root is highly esteemed by the Santals as a remedy for affections of the throat (Campbell).

Among the Mundas the petioles, ground and mixed with water, are given to drink to cattle affected with throat disease,

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The leaves and roots are a common remedy for piles in Ceylon.

Bengal: Kantakachu—; *Burma*: Zayap—; *Malay*: Bekil, Gli-gli—; *Mundari*: Janumsaru—; *Santal*: Rantasaru—; *Sinhalese*: Kohilla, Mahakshilla—; *Telugu*: Kantakachoramu, Mulasari—.

PISTIA.

The only species of this genus, **Pistia stratiotes** Linn., is a stemless stoloniferous floating herb found in still sweet water throughout India and Ceylon. It occurs in the tropics and subtropics, with the exception of Polynesia and Macronesia. In the Malay Peninsula it is commonly cultivated by the Chinese to feed pigs on.

The Ayurvedists consider the plant to be cooling and laxative; useful in diseases of the blood and tuberculous glands.

The Yunanists describe the root as bitter, diuretic, good for wounds, inflammations and burns.

The plant is cooling and demulcent, and is given in dysuria. It is said to destroy bugs most effectively.

The root is laxative and emollient.

The leaves are made into poultices and applied to haemorrhoids. Mixed with rice and cocoanut milk they are given in dysentery, and with rose-water and sugar in cough and asthma.

The ashes are applied to ringworm of the scalp.

The Mundas use the juice of the plant medicinally in ear complaints.

The whole plant has long been employed in ancient Chinese prescriptions. It is applied to boils, syphilitic eruptions and in many skin complaints.

A decoction of the leaves is used in La Reunion as a diuretic and prescribed in diseases of the urinary tract. Made into pills the leaves are used in syphilis.

The natives of the Gambia use the plant as an anodyne eye-wash: the leaves are soaked in cold water. If the plant comes in contact with the body it produces a sharp stinging sensation, like a nettle sting, and the pain continues for some minutes.

An oil was prepared by boiling the juice of the leaves in cocoanut oil and used externally in chronic skin diseases. Relief was obtained in a number of cases (Koman).

Arabic: Satar-al-tayutas—; *Ashanti*: Ntanoa, Todia—; *Awuna*: Aflo—; *Bengal*: Pana, Takapana—; *Bombay*: Gondala, Prishni—; *Cagayan*: Aluluan—; *Canarese*: Antaragange—; *Chinese*: Fou Ping—; *Deccan*: Anterghunga—; *Egypt*: Hay-adem-el-ma—; *English*: Water Lettuce, Water Soldier—; *Ewe*: Aflo—; *Fanti*: Ntangtangaba—; *Ga*: Taitraimantai—; *Gambia*: Eye-pity—; *Gujerati*: Jalakumbhi—; *Hausa*: Kainuwa—; *Hindi*: Jalkhumbi, Takapana, Unterungha—; *Hova*: Tsinkafonkafona—; *Ilocano*: Loloan—; *La Reunion*: Pensée d'eau, Pourpier de Madagascar—; *Madagascar*: Azafo, Hazafo—; *Malaya*: Fow phing, Kambiang, Kiambang—; *Malayalam*: Koddapail—; *Marathi*: Gondala, Jalamandri, Prasni—; *Mundari*: Jhalkumbhi—; *Sadani*: Jhalkumbhi—; *Sanskrit*: Akashamuli, Ashakumbhi, Daladhaka, Jalavalkala, Khali, Khamulika, Kumbhika, Kumuda, Kutrina, Paniyaprishthaja, Parni, Prashni, Shvetaparma, Untareitamara, Varimuli, Variparni—; *Sinhalese*: Atiudayan, Dayaparandella—; *Tagalog*: Quiapo—; *Tamil*: Agasatamarai—; *Telugu*: Akasatamara, Antaratamara, Koddapail, Nirubudiki—; *Tongking*: Beo cai—; *Twi*: Ntaya—; *Urdu*: Jalakumbhi—; *Uriya*: Baujhanjhe—; *Uruguay*: Lechuguita de agua, Ropollito de agua—; *Visayan*: Cayapo, Louanlouan,

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PLESMONIUM.

The genus is represented by **P. margaritiferum** Schott, a tuberous herb flowering before leafing and found in Bengal.

The country-people in Goa use the crushed seed to cure toothache; a small quantity is placed in the hollow tooth and covered with cotton; it rapidly benumbs the nerve; they also use it as an external application to bruises on account of its benumbing effect.

Among the Mundas the raw tuber, well ground, is rubbed on swellings of the extremities. The tubers are eaten. If they are not boiled in several successive kettlefuls of water, or together with tamarind leaves or tamarind pulp, they keep a noxious acidity which affects the throat and mouth with unbearable itching. It is said that the itching has sometimes proved fatal. Acid drinks are a counterpoison. The tamarind added ought, therefore, not to be spared.

Biru: Bonggajorena—; *Goa*: Azomut, Uzomut—; *Hasada*: Birhada, Hada—; *Nagpuri*: Hada, Tonanghada—; *Oudh*: Kharhar—.

POTHOS.

The genus includes 60 species, inhabitants of tropical Asia, Australia, Polynesia and Madagascar.

Bracts large concave thickly coriaceous ...	... 1. *P. cathcartii.*
Bracts very small	... 2. *P. scandens.*

1. Pothos cathcartii Schott occurs in the tropical Himalaya from Kumaon to Bhutan, Assam, the Khasia Hills, Manipur and Burma.

In Lakhimpur the leaves, fried in ghee, are eaten to cure various pains.

Lakhimpur: Hathidenkiya—.

2. Pothos scandens Linn. is found throughout India, on walls and tree trunks, from Bengal eastwards to Burma, and southwards to Singapore, and from the Konkan to Ceylon, the Andamans and the Nicobar Islands, extending to the Malay Islands and China.

The bruised stem and leaves are mixed with ox-urine and applied to the wounds in snake-bite; and an aqueous extract of the fresh stem and leaves is given internally (Roberts).

The stem and leaves have no effect in the treatment of snake-bite, whether taken internally or applied externally (Mhaskar and Caius).

Badaga: Arkaburu—; *Canarese*: Adikabiluballi—; *Malayalam*: Anappa-ruva—; *Siamese*: T'kep—; *Sinhalese*: Potawel—.

var. **cognatus** Engler, known in Malaya as 'Juloh-juloh', is used medicinally by the Malays. The powdered leaves are applied to the body to cure small-pox; the stem, cut up with camphor, is smoked like tobacco for asthma.

REMUSATIA.

The genus consists of 2 species, inhabiting tropical Asia and Africa.

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Remusatia vivipara Schott is found in the subtropical Himalaya from Kumaon to Sikkim, the Khasia Hills and Burma, Chota Nagpur, the Western Ghats, Mysore and Ceylon. It extends to Cochin-China, Java and tropical Africa.

The root is made into an ointment with turmeric and used as a remedy for itch; and the juice with cow's urine is considered to be alexipharmic (Rheede).

Marathi: Rukhalu—; *Matheran*: Rokhalu—.

Rhaphidophora.

The genus includes 60 Indo-Malayan species.

Rhaphidophora pertusa Schott (=*Scindapsus pertusus* Schott) is a tall climber found in the Deccan Peninsula, the Coromandel Coast, Malabar, Ceylon and the Malay Islands.

The juice of the plant with black pepper is given to people who are bitten by the Russell's Viper. The juice, with that of the roots of *Croton oblongifolium*, and of the fruit of *Momordica charantia* is also applied to the bitten part.

This treatment is ineffective (Mhaskar and Caius).

Jolo: Mamao—; *Malayalam*: Anachukiri, Ilattimaravala—; *Marathi*: Ganeshkanda—; *Tagalog*: Pacpaclauin—; *Tamil*: Ilattimaravalai—; *Telugu*: Enuganalleru—; *Visayan*: Dayia—.

Sauromatum.

The genus consists of 4 palaeotropical species.

Sauromatum guttatum Schott occurs in the Punjab, the Gangetic Plain, the Western Himalaya, Chota Nagpur, the Bombay Presidency and Burma; extending to Sumatra.

The tubers are used as a stimulating poultice.

Bombay: Loth—; *Central Provinces*: Bhasamkand—.

Scindapsus.

The genus consists of 20 Indo-Malayan species.

Spathe green without yellow within, 4-6 in. oblong sub-cylindrical beaked. Spadix greenish-yellow ...	2. *S. officinalis.*
Spathe white or pale yellow, 2-2½ in. boat-shaped acuminate narrow long-beaked. Spadix white ...	1. *S. hederacea.*

1. **Scindapsus hederacea** Schott is found throughout the Malay Peninsula, climbing on rocks and trees in the low country.

A decoction of the stem is used by the Malays for rheumatism.

Malay: Akar lubang alah, Akar ular—.

2. **Scindapsus officinalis** Schott occurs in the tropical Himalaya from Sikkim eastwards, Bengal, Chittagong, Burma and the Andamans.

The ripe fruit is described in the Nighantas as pungent, sharp, heating, anthelmintic, aphrodisiac, galactagogue; sharpening hearing and appetite; regulating the bowels; useful in dysentery, asthma and troubles of the throat.

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Mahommedan writers speak of the fruit as aphrodisiac, cardiotonic; useful in ozoena and bronchitis.

The dried fruit is commonly used as a stimulant, diaphoretic, and anthelmintic.

Among the Santals the fruit is applied externally for rheumatism.

A decoction of the sliced fruit was tried in cases of asthma and found to act as an expectorant; it did not diminish the severity of the fit (Koman).

Bengal: Gajapipal, Gajapipul—; *Canarese*: Doddahippali, Gajahippali—; *Deccan*: Hattipipli—; *Dehra Dun*: Poriabel—; *Gujerati*: Mottopiper—; *Hindi*: Braipipli, Gaja pipal, Gajapipli, Maidah, Pippaljhhanca—; *Malayalam*: Anattippali, Attittippali—; *Marathi*: Thorapimpli—; *North-West Provinces*: Gajpippali, Hath, Ungliya—; *Sanskrit*: Chavyaphala, Chhidravaidehi, Dirghagranthi, Gajakrishna, Gajapippali, Gajavha, Ibhakana, Iboshana, Kapivalli, Karipippali, Kolavalli, Kunjarapippali, Shreyasi, Tejasi, Vartuli, Vashira—; *Santali*: Darejhapak, Dharejhapak—; *Tamil*: Anaittippili—; *Telugu*: Enngatippali, Gajapippali—; *Urdu*: Gajapippali—; *Uriya*: Girudhuni, Gojopippoli, Odisimo—.

Synantherias.

The genus is limited to 1 species, **S. sylvatica** Schott, found in the Deccan Peninsula, from the Northern Circars to the Konkan, and Ceylon.

The plant is pungent, anthelmintic, heating; improves taste; useful in tumours, pains, piles; causes biliousness.

The country people use the crushed seed to cure toothache. A small quantity is placed in the hollow tooth and covered with cotton; it rapidly benumbs the nerve; they also use it as an external application to bruises on account of its benumbing effect. In the Konkan, the seeds rubbed into a paste with water are applied repeatedly to remove glandular enlargements. The taste of the fruit is intensely acrid; after a few seconds it causes a most painful burning of the tongue and lips, which lasts, for a long time, causing much salivation and subsequent numbness.

Goa: Uzomut—; *Marathi*: Wajramuta—; *Sanskrit*: Aranyasurana, Chitrakandaka, Shvetasurana, Sitasurana, Surendra, Vanja, Vanakanda, Vanaolla, Vanya—.

Typhonium.

The genus includes 25 Indo-Malayan species.

Typhonium trilobatum (Linn.) Schott is found in the Eastern and Western Peninsula and Ceylon, in Bengal, Assam, Chittagong, Burma, the Malay Peninsula. It extends to Siam, Cambodia, Tongking, Borneo and Java.

The roots are exceedingly acrid, and used in poultices; and also applied externally to the bite of venomous snakes, at the same time given inwardly about the size of a field bean. It is certainly a most powerful stimulant.

The acrid principle is very volatile; and by the application of heat, or by simple drying, the root becomes innocuous or even a wholesome article of diet. As an article of food, it relaxes the bowels and thereby relieves haemorrhoids,

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The tubers eaten with bananas cure stomach complaints.

Mhaskar and Caius have shown experimentally that the root is not an antidote to snake venom.

Bengal: Ghetkochu—; *Hasada*: Cakad, Nirbisi, Niribisi—; *Malayalam*: Chena—; *Naguri*: Najompicki—; *Sinhalese*: Panuala—; *Tamil*: Karkarunaikkilhangu, Karunaikkilhanga—; *Telugu*: Duradakandagadda, Kandagadde—.

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OBSERVATIONS OF SOME PECULIAR HABITS OF THE SPIDER (*MARPISSA MELANOGNATHUS*).

BY

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Bose Research Institute.

(*With two plates*).

In June, 1934, while passing along the compound of the Science College, Ballygunge, I noticed a thick column of minute biting ants, *Solenopsis geminata*, on the fencing of the compound. The column was unusually long and thick and the workers were very busy carrying minute particles of food-stuffs and eggs from an old stump of a tree to a new place of shelter at a distance of about thirty yards. While observing their activities my attention was drawn to a young spider, *Marpissa melanognathus*,[1] which was rushing and pausing at a little distance along a line parallel to that of the ants. From the movements of the spider I surmised that it wanted to cross the line of ants, but dared not do so. Curiously enough, a few minutes later, the spider instead of passing across, as I thought it wanted to do, fell upon the swarm of ants, carrying the food-stuffs and eggs, and ran away to a safe distance after snatching a morsel from one of them. Great consternation arose in that peaceful column, resulting in a disturbance in the regular line of march; the ants scattering in all directions. The ants, unable to move as fast as the spider, tried to follow the raider in vain. Irregularity in movements due to this disturbance spread over the entire column, but this was for a few seconds only. Soon the disturbance subsided, and it seemed that the pace of the carrier-ants was much more accelerated than before. In the meantime the spider having devoured the stolen food came back to its former position and waited intently for a fresh attempt. I thought it to be a stray case of snatching ants' food by a wandering spider, who happened to come across the ant caravan. But a few minutes later, when I moved to a different part of the line, two other younger spiders of the same species attracted my attention. They too lay in ambush by the side of the column evidently with the same purpose of raiding the ants. For two hours and a half I watched the activities of these spiders who successfully managed to snatch eggs or food from the ants several times. In one or two cases only their objective was missed, but the ants were so frightened that they dropped the eggs or food-stuff. After this, on several other occasions I observed similar raids on these ants by *M. melanognathus*. From which I am inclined to conclude that the young of this spider, until it matures, subsists largely on food or eggs taken from the

[1] J. H. Comstock, *The Spider Book*, p. 678, New York, 1920.

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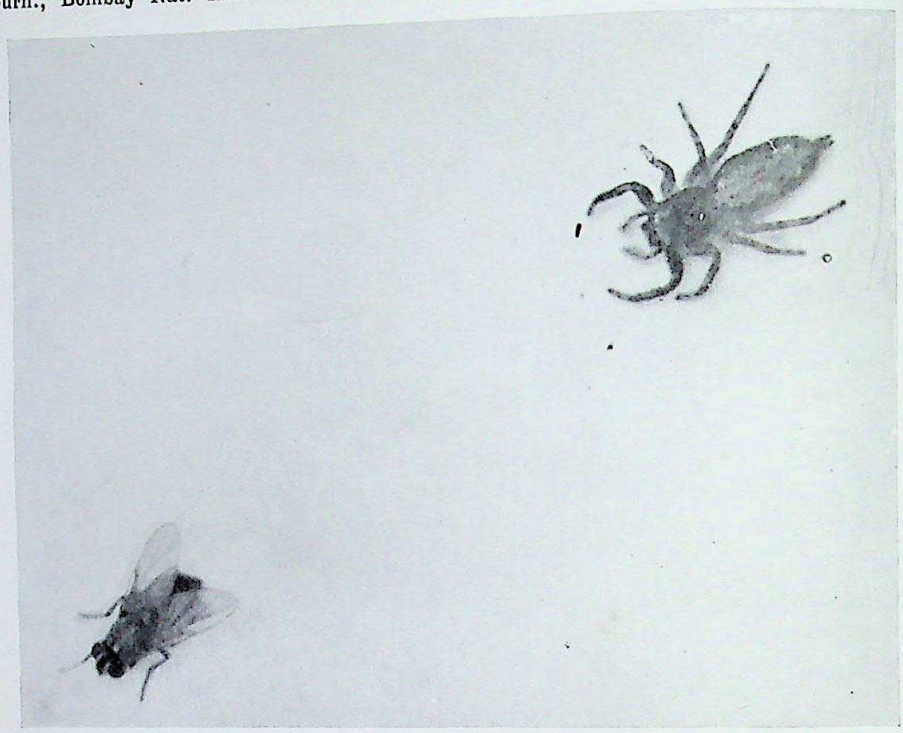

Fig. 1.—The spider (*M. melanognathus* ♀) stealthily approaching a sitting fly from behind.

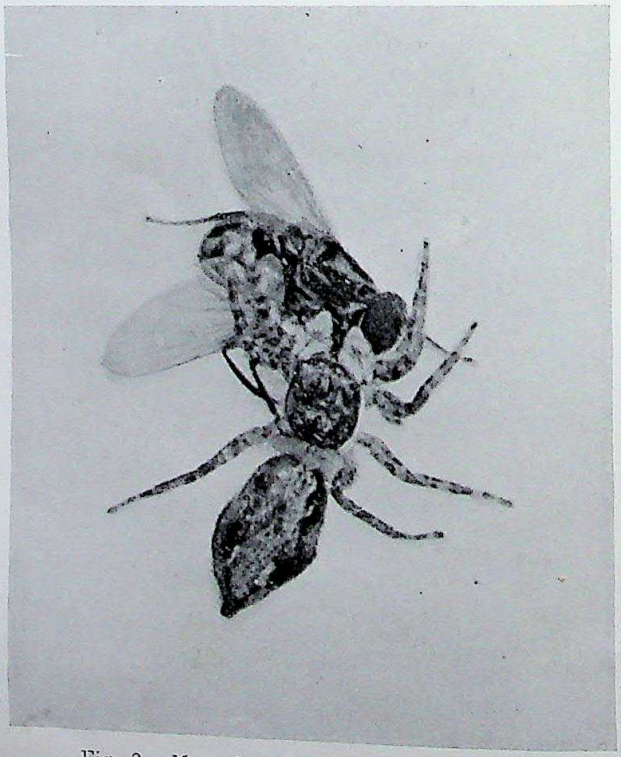

Fig. 2.—*M. melanognathus* ♀ seizing the fly.

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ants, *Solenopsis geminata*, where they are abundantly distributed (Fig. 1).

M. melanognathus is a common spider found almost everywhere in Bengal. During the summer months they are seen loitering on the walls and floors of houses in search of prey. They spin no web, save for a shelter at the time of laying eggs. It is a white canopy built in a corner or a crevice of the house-walls, of oval shape and made up of three separate layers. Eggs are laid under the first layer and upon it the mother spider spends most of her time. Above this layer, there are two separate covers built one above another, while two doors, one opposite the other, are kept for coming in and goint out. Sometimes, before laying eggs, the female entertains the male on the upper layer of her retreat. Unlike most of other spiders, the female goes out hunting and carries her victims to a secluded place to feed undisturbed upon them. After reaching the adult stage they prey upon the common house-fly (*Musca domestica*). Their mode of capturing flies is marvellously skilful. The spider stalks the fly from a distance of about two feet or more. A fly is sitting on the floor, the spider advances towards it slowly, when close, it moves with still greater caution (Fig. 1). It approaches still closer; if it finds the fly facing it, the spider changes its course and moving backwards in a wide circle approaches the fly from behind. It then crawls towards the prey and, when in easy reach, jumps upon it (Fig. 2). Its spring is very accurate, it seldom misses its first attempt. In rare instances, a flank attack is made. A sitting fly usually appears to be too engrossed in its toilet to realise the imminent danger of an approaching spider even at close quarters. There might be an additional explanation of this apparent carelessness on the part of the fly, viz., that it cannot see things clearly from the distance at which the sharper-sighted spider can see without much difficulty. Moreover, the spider, though not a mimicking one, looks more or less like a fly when it stealthily crawls towards the victim.

These spiders are of quarrelsome habit. A chance meeting of two, if they happen to be of the same sex, results in the stronger one invariably attacking the weaker. If both the parties happen to be of equal strength they approach each other, raising their fore-legs upwards and rush headlong in a contest. The following incident will show clearly how aggressive these spiders are.

An adult spider *M. melanognathus* dropped on to a table from above, and remaining motionless for a while, jumped upon the polished stand of an apparatus at which I was working. The reflection of its own image in the polished surface of the stand attracted its attention. With raised body and lowered cephalothorax it looked intently at its image, which it took for another spider. It moved up and down the stand to seize its imaginary opponent. Being disappointed, it became angry and raising its fore-legs, dashed furiously at the stand. Unable to seize its supposed opponent, it stopped a while to recover from the shock. It followed its reflection round the stand and dashed as ineffectively against it. Failure after failure made the spider so furious that

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it dashed repeatedly against the surface, at times springing at its reflection from a little distance. The same operation, with short intervals of rest, was repeated for more than ten minutes. The spider now exhausted, gave up the attempt and walked away from the spot.

The courting of these spiders, previous to mating, may be of interest. The amorous gestures performed by the male before mating are not as elaborate as those of the *Lycosid* spiders. The male advances towards the female with his fore-legs raised and keeping at a respectable distance moves forwards and backwards (Fig. 3). This continues for a long time. He now comes closer and caresses her with his raised fore-legs (Fig. 4). The female treats these demonstrations with unconcern. She moves here and there as though busy in search of prey and not interested in the matter. During this procedure, when opportunity offers, the male gets upon her back and turning the abdomen inserts the intromittent organ into the orifice several times at intervals. The female never attacks the male after mating as is wont with some species of *Lycosid* spiders.[1] *

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[1] G. Bhattacharya, *Transactions of the Bose Research Institute*, vol. vii, p. 248 (1931-2).

* A superstition about this particular spider is prevalent among the Hindus of Eastern Bengal that the spider carrying a fly in its jaws is considered as an indispensable sign of good luck by the bride's party on the occasion of marriage ceremony and these spiders are therefore carefully collected alive for the purpose. Similar superstitious beliefs are not rare or unknown even in Western countries. (Vide *Notes and Queries*, vol. ii, p. 165; ibid., vol. iv, 2nd. ed., pp. 198 and 377; and *Am. Spid. and their Spin. Work*, vol. iii, pp. 81-3.)

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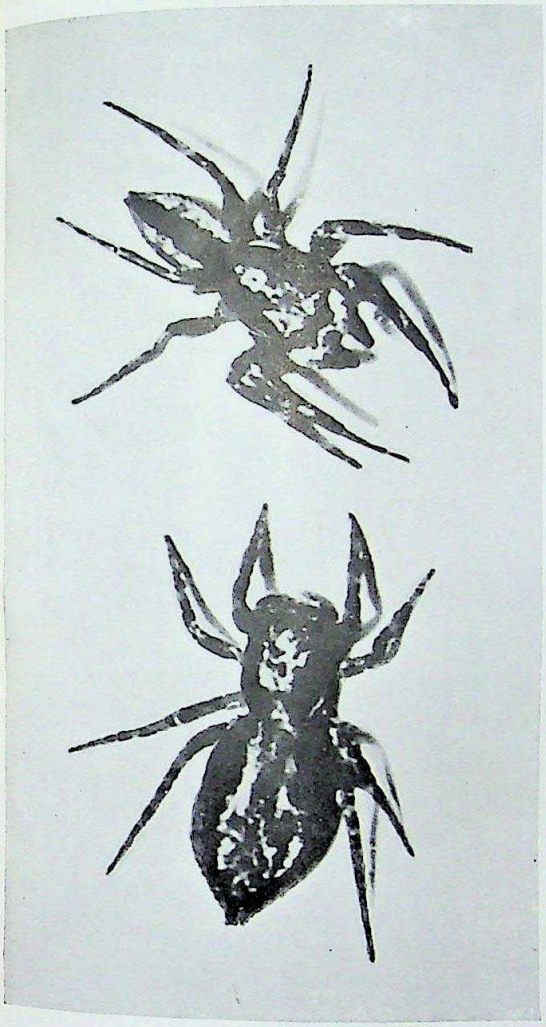

Fig. 3.—The male spider courting the female prior to mating.
Above—*M. melanognathus* ♂.
Below—*M. melanognathus* ♀.

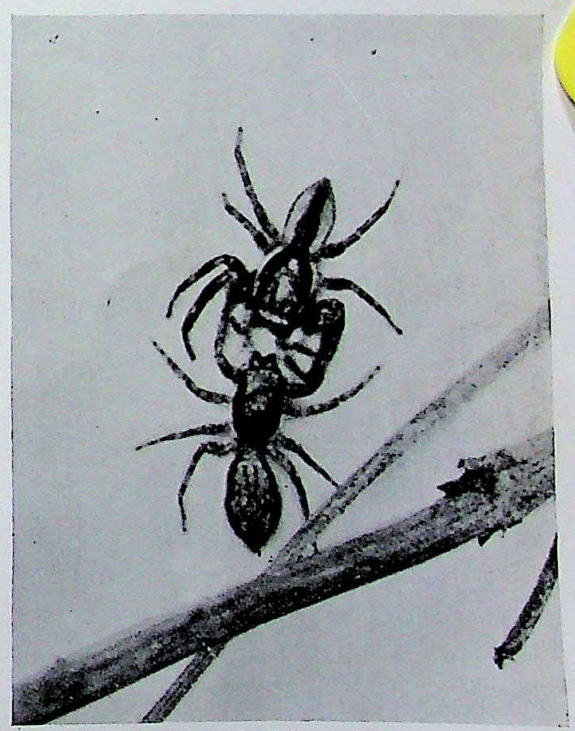

Fig. 4.—The male (above) is caressing the female (below) with raised forelegs.

Courting attitudes of the spider (*Marpissa melanognathus*).

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AN UNDESCRIBED TINGITID FROM SOUTH INDIA.

BY

CARL J. DRAKE.

(*Ames, Iowa, U.S.A.*).

The present paper is based upon a small collection of lace bugs from South India kindly sent to the writer by Mr. M. C. Cherian for identification. One species, *Monanthia cheriani* Drake, is described below as new to science.

Monanthia cheriani Drake, sp. nov.

Small, body black, the reticulations whitish testaceous. Antennae slender, whitish; segment I short, a little longer and slightly stouter than II; III very slender, three times as long as IV; IV slightly enlarged, the distal two-thirds dark brown. Head moderately convex above, black, armed with five slender whitish spines; anterior pair short, very slender, resting on the surface of the head; posterior pair and median spines long, directed forward, contiguous with the surface of the head; extending almost to the anterior margin of the eyes. Rostrum testaceous, darkened at tip, not quite reaching the intermediate coxae. Legs slender, testaceous, the tarsi darker.

Collum raised, reticulate, faintly produced anteriorly. Paranota broad, testaceous, turned back upon the dorsal surface of the pronotum, the outer margin broadly rounded and almost touching the median carina. Carinae testaceous; median carinae slightly more raised behind, there with long, low areolae; lateral carinae short, confined to posterior triangular portion of pronotum, faintly divaricating. Pronotum black, the reticulation of posterior portion testaceous. Elytra broadest near middle, faintly constricted a little beyond the middle, considerably longer than abdomen; costal area rather narrow, uniseriate, testaceous, mostly biseriate, triseriate in widest part, the areolae rather large; discoidal area almost reaching middle of elytra, rather widely reticulate, with five areolae in widest part, narrowed towards base, widest near apex, there with the outer margin bowed outwardly and with a distinctly raised, brownish black point on the boundary, the inner margin distinctly curved; areolae hyaline, the nervelets of discoidal and basal portion of sutural areas blackish.

Length, 2.12 mm.; width, .90 mm.

Holotype (male) and *allotype* (female), Coimbatore, India, on *Corida* sp., March 1, 1920, collected by Dr. T. V. Ramakrishna Ayyar, in Drake collection. Paratypes, 4 specimens, taken with type, in collections of M. C. Cherian and author.

Hormisdas vicarius Drake.

Travancore, South India, 5 examples, taken on *Urena lobata* L., by Mr. M. C. Cherian. Heretofore known only from the Philippines.

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NOTES ON COCCIDÆ (*HOMOPTERA RHYNCHOTA*) FROM SOUTH INDIA.[1]

BY

RAO SAHIB DR. T. V. RAMAKRISHNA AYYAR, B.A., PH.D.,

Late Government Entomologist, Agricultural Research Institute, Coimbatore.

INTRODUCTION.

Fresh data on the South Indian Coccidæ collected since the publication of my previous papers[2] on these insects, are recorded in this paper. The material reported here comprises twenty-nine species distributed over seventeen genera. Six of these species are new to science and are being described by Green elsewhere. Seven well known species are being recorded for the first time from South India.

I am greatly indebted to Prof. E. E. Green, the well known authority on these insects, for his kind help and valuable suggestions.

SYSTEMATIC ACCOUNT.

Sub-family: DIASPINÆ.

Leucaspis riccæ Targ.

This well known species is now recorded for the first time from South India. Numerous specimens were taken on an unknown plant at Hyderabad, Deccan.

Pinnaspis marchali Cockl.

This species was originally described from West Africa, where it attacks the Oil palm. It is very common on Western Ghats in South India. Numerous specimens were taken on the spikes of *Piper nigrum* along with another species *P. aspidistræ* Sign. at the Taliparamba pepper farm, Malabar.

Aspidiotus lataniæ Sign.

This species was previously recorded on *Ficus carica* from Ceylon, on *Phœnix* from Calcutta, on *Citrus* sp. from Bombay, on *Carissa* and sissal hemp from Coimbatore and apple stems from the Shevaroys. I recently collected this species on *Acacia dealbata* from the Nilgiris.

Aspidiotus tamarindi Green.

This common species is an important pest of *Tamarindus indica* Linn. I have recently bred the Chalcid parasite *Comperiella indica* Ramakr.[3] from this scale at Coimbatore.

Aspidiotus (Chrysomphalus) aurantii Mask.

This species was previously recorded on mulberry at Pusa and pomelo at Myitkyina. This is also reported as a serious pest of oranges in California

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[1] This paper was read at the Twenty-third Session of the Indian Science Congress held at Indore in January 1936.

[2] Ramakrishna Ayyar, *Journ., Bombay Nat. Hist. Soc.*, xxvi, 621-8 (1919); *Rep. Proc. Fourth Ent. Meet. Pusa*, pp. 336-62 (1921); *Bull. Imp. Council Agric. Res. Inst., Pusa*, No. 197, pp. 76 (1930).

[3] Ramakrishna Ayyar, *Rec. Ind. Mus.*, xxxvi, p. 219 (1934).

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and other important orange-growing countries. It is widely distributed in India and is known as an important pest of citrus plants. From South India the species was previously reported on guava, rose, morinda, jasmine, etc. I recently noted this species on oranges at Coimbatore and the Nilgiris. The species has not previously been reported on oranges from South India and it might prove an extremely dangerous pest.

Aspidiotus (Pseudaonidia) trilobitiformis Green.

Taken on guava at Coimbatore; this is the first record of this species on this plant.

Lepidosaphis beckii New.

This species was originally reported on pepper from Travancore and is now being recorded for the first time on citrus plants from the Nilgiris. This is an important pest of citrus plants.

Lepidosaphis hawaiiensis *var.* **indica** Green.

This variety was taken on the bark of *Albizzia* at Coimbatore.

Lepidosaphis cornutus, sp. nov. (Green Ms.).

Numerous specimens generally resembling *L. piperis* Green were taken on leaves and vines of the betel vine, *Piper betle*, at Tirukulum, North Arcot District. The specimens differ from those of *L. piperis* in the short tubercular spine on either side of the head and Green has determined them as belonging to a new species, which he is describing under the name *cornutus*.

Parlatoria proteus Curt.

This species was previously reported on *Cymbidium bicolor* from Ceylon and on *Vanda* and other Orchids from Bangalore. I recently noted numerous specimens on *Aerides bridleyanum* in the Nilgiris.

Parlatoria mangiferæ Marl.

Noted on *Commiphora berryi* at Coimbatore.

Paralatoria blanchardi Targ.

This is the first record of this species from India. Originally reported on date palm from West Africa, it is being recorded on the same plant from Hyderabad, Deccan.

Sub-family: LECANIINÆ.

Ceronema kœbeli Green.

This species was previously reported on *Sapium sebiferum* and *Pithecolobium* from Ceylon and is being recorded for the first time from South India. Numerous specimens were taken on *Cæsalpinia* sp. at Coimbatore.

Pulvinaria durantæ Tak. (?)

This species is closely related to *P. psidii* Green. Numerous specimens were taken on *Amaranthus* sp. at Coimbatore.

Pulvinaria maxima Green.

Since the publication of my previous paper[1] on this species the following parasites have been bred from specimens taken on Melia at Coimbatore: *Anicetus ceylonensis* (How.), *Encyrtus flavus* How. and *Perrisopterus* sp.

Pulvinaria psidii Green.

The following Chalcid parasites were recently bred by me from specimens of this species taken at Coimbatore: *Encyrtus kotinskyi* (Full.), *Adelencyrtus chionaspidis* (How.), *Aphelinus mytilaspidis* Le Baron and a species of *Coccophagus*.

Lecanium marsupiale Green.

This species was previously reported on pepper, *Pothos* and *Anona* from Ceylon. Numerous specimens attacking pepper were recently received from Coorg.

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[1] Ramakrishna Ayyar, *Mem. Dept. Agric. Ind., Ent. Ser.*, viii, p. 30 (1925).

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Lecanium latioperculum Green.

This species was taken on *Anacardium occidentale* Linn. in Malabar.

Aclerda japonica *var.* **inermis** Green.

Numerous specimens of this species were taken on the leaf-sheath of sugar-cane at Anakapalle, Godavari District, along with *Pseudococcus* (*Trionymus*) *sacchari* Cockl.

Sub-family: ASTEROLECANIINÆ.

Cerococcus ramakrishnæ sp. nov. (Green Ms.).

This new species is related to *C. ovoides* Cockl., from which it is distinguished mainly by its larger size. Specimens of this species were taken on rootlets of *Ficus* sp. at Coimbatore.

Sub-family: DACTYLOPIINÆ.

Pseudococcus (Ferrisia) virgatus Cockl.

This species is common on *Dolichos lablab* at Coimbatore and Malabar.

Trionymus sacchari (Cockl.).

This well known species is a rather serious pest in almost all sugar-cane growing countries. It has also been noted on paddy from South India. Attacks of this species on the roots and leaf-sheaths of sugar-cane and sorghum recently came under my notice at Anakapalle. My remarks in my previous paper[1] on the *soorai* disease of the paddy plant do not really refer to this species, but to the following species.

Ripersia oryzæ Green.

This species is the cause of the common *Soorai* disease of the paddy plant in the Tanjore delta. It has recently been found in Malabar also. Besides the paddy plant, the species attacks numerous other species of grasses including the ragi, *Eleusine coracana*.

Pseudantonina rigida, sp. nov. (Green Ms.).

This species was taken on the grass *Iseilema laxum* Hack. at Samalkota, Godavari District.

Pseudantonina imperata, sp. nov. (Green Ms.).

On the grass *Imperata arundinacea* at Anakapalle.

Antonina zonata Green.

This is the first record of this species from India. Taken on bamboo at Coimbatore.

Icerya pilosa Green.

In 1896, this species was reported on the common shrub of the sand dunes, *Spinifex squarrosus* Linn. from the Coromandel Coast of the Madras Presidency. It has recently been reported on the same plant from the West Coast also.

Icerya purchasi Mask.

This serious exotic pest found its way into India somewhere about the years 1928 and 1929 and was first reported on wattles (*Acacia*) from the Nilgiris. I have recently noted the species on a few other plants, including citrus near about Coonoor, Nilgiris. The rapid multiplication of the species appears to have been somewhat checked by the introduced lady-bird, *Novius cardinalis*, which is predaceous on it. The species does not as yet appear to have found its way to the plains.

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[1] Ramakrishna Ayyar, *Bull. Imp. Council Agric. Res. Ind., Pusa*, No. 197 p. 59 (1930).

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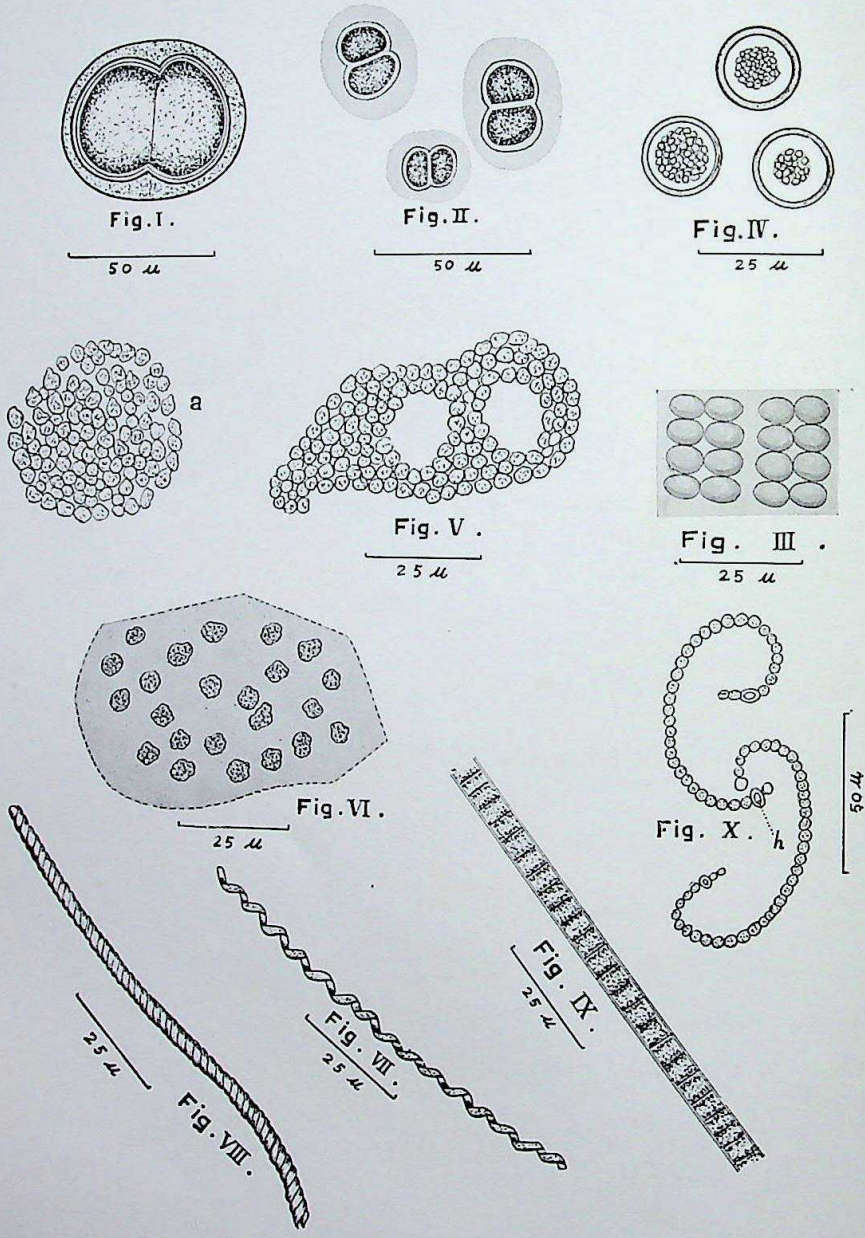

ALGAL FLORA OF HYDERABAD, DECCAN.
(*For explanation see text*).

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A PRELIMINARY SURVEY OF THE ALGAL FLORA OF HYDERABAD (DECCAN).

PART I. Myxophyceæ

BY

M. GHOUSUDDIN, M.SC. (Alig.)

(With two plates).

The study of the Algal Flora of Hyderabad State has been taken up recently. The State with its varying ecological conditions deserves an extensive investigation, and the results are sure to be of general interest. The scope for research on the Fresh-water Algae of the Nizam's Dominions is facilitated by the existence of more than 18,000 natural and artificial tanks, which are the chief supply for irrigation and drinking purposes throughout the State. In connection with my work on the 'Distribution of the Diatoms in the Nizam's Dominions', to be published elsewhere, material of other fresh-water algae was also collected and preserved during the last two years and is now to be described briefly. For the present I consider the commonly distributed forms, which are met with and reported from other parts of India also; but as this is the first record from the Dominions, it may be of some interest. Owing to lack of full literature only common types have been dealt with, but an extensive study of the material collected is in progress and will be published in due course.

UNICELLULAR AND COLONIAL FORMS.

Cells or colonies free floating or forming a gelatinous stratum. Reproduction by simple cell division. . . Family: CHROOCCOCCEAE.

Cells globose with firm, thick membrane, solitary and free floating (Fig. i, pl. I). *Chroococcus giganteus* West.

Cells solitary, free floating with colourless sheaths (Fig. 2, pl. I). *C. turgidus* (Kutz) Nag.

Collections from Husain Sagar and Mir Alam tanks show a fair number of both the species.

Cells spherical, adhering in groups of four and arranged in rows to form flat rectangular colonies. Abundant (Fig. 3, pl. I). *Merismopedia elegans* A. Braum.

Colony spherical, sheaths colourless, indistinctly lamellose cells spherical or angular by mutual pressure, blue-green—from Husain Sagar (Fig. 4, pl. I). *Gloeocapsa aeruginosa* (Carmich) Kutz.

Colonies at first spherical, later irregular in shape. Cells spherical, numerous, blue-green or brown. Common (Fig. 5, pl. I). *Clathracystis aeruginosa* (Kutz) Henfery.

Cells embedded in a gelatinous matrix to form spherical colonies. Cells globose, contents granular, blue-green (Fig. 6, pl. I). *Aphanocapsa grevillei* (Hass) Rabenhorst.

FILAMENTOUS FORMS.

(A) The trichomes consist of a single uniform row of cells, not branched, heterocysts absent. Enclosed in more or less gelatinous sheaths of variable size. Family: OSCILLATORIACEAE.

Trichomes not more than one in a sheath, filaments unbranched. Sub-family: LYNGBYEAE.

Trichome narrow, twisted into a regular spiral, the coils apart (Fig. 7, pl. I). *Spirulina major* Kutz. Trichomes relatively wide, coils closely arranged (Fig. 8, pl. I). *S. turfosa* Cram.

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Trichomes of both the species are often observed in the collections mixed with other forms, but almost pure material of *S. turfosa* with a fair proportion of *S. major* was found in a little pool near Isolation Hospital, University Road.

Trichomes free or interwoven to form a thin substratum, cells cylindrical, without conspicuous sheaths, with oscillating movements. OSCILLATORIA Vaucher.

(1) Filaments long, straight with obtusely rounded apex, slightly constricted at the joints, cell contents granular olive green or brown (Fig. 1, pl. II). *Oscillatoria limosa* Ag.

(2) Filament long, straight or curved, cells about 1/6 in length then wide, apical cell slightly capitate, cell contents granular, dark green to bluish gray (Fig. 2, pl. II). *O. princeps* Vauch.

(3) Filament long, straight with rounded apex, constricted at the joints, cells less than ½ as long as broad, pale bluish-green, mixed with other filamentous algae (Fig. 3, pl. II). *O. tenuis* Ag.

Filaments not showing oscillating movements with conspicuous, firm sheaths, free floating or forming an expanded substratum. LYNGBYA C. Agradh.

(1) Filaments flexuous forming intricate masses, dark blue-green, sheath thin, hyaline, cells almost quadrate, not constricted, apical cell round not capitate. Common (Fig. 9, pl. I). *Lyngbya aerugineo-caerulea* Kutz.

(2) Filaments long, sheaths coated with iron-hydroxide, cells quadrate. *L. ochracea* Kutz.

Common in the River Moosi.

(B) Filaments simple, unbranched, heterocysts present, free floating or embedded in gelatinous masses, sheaths unconspicuous and confluent. Cells generally torulose in a single row. Family: NOSTOCACEAE.

Colonies spherical, later on irregular filaments irregularly interwoven and contorted. Cells globular or barrel shaped, with intercalary heterocysts. Colonies forming yellowish-brown gelatinous masses in the River Moosi and adjacent ponds (Fig. 10, pl. I). *Nostoc commune* Vaucher.

Filament single, free floating, wound in spirals, cells almost spherical, heterocysts a little larger than the vegetative cell. Stray filaments met with in a collection made from a small pond near Umdasagar (Fig. 6, pl. II). *Anabaena spiroides* Kelb.

Filament single, free, vegetative cells cylindrical, usually longer than the diameter, heterocyst terminal, spore oval, big, next to the heterocyst. Rare in the River Moosi and Mir Alam Tank (Fig. 7, pl. II). *Cylindrospermum stagnale* Born et Flah.

(C) Filaments in a firm sheath with intercalary heterocysts, filament with false branching. Family: SCYTONEMATACEAE.

Branches arising generally in pairs, cells about twice as long as broad, apical cell rounded, heterocysts intercalary, abundant on the banks of Mir Alam and Husain Sagar tank (Fig. 4, *a*, *b*, *c*, pl. II). *Scytonema mirabile* Thurst.

Branches arising as a rule singly, arising from the main filament beneath a heterocyst, heterocyst intercalary shorter than the vegetative cells (Fig. 5, pl. II). *Tolypothrix* sp.

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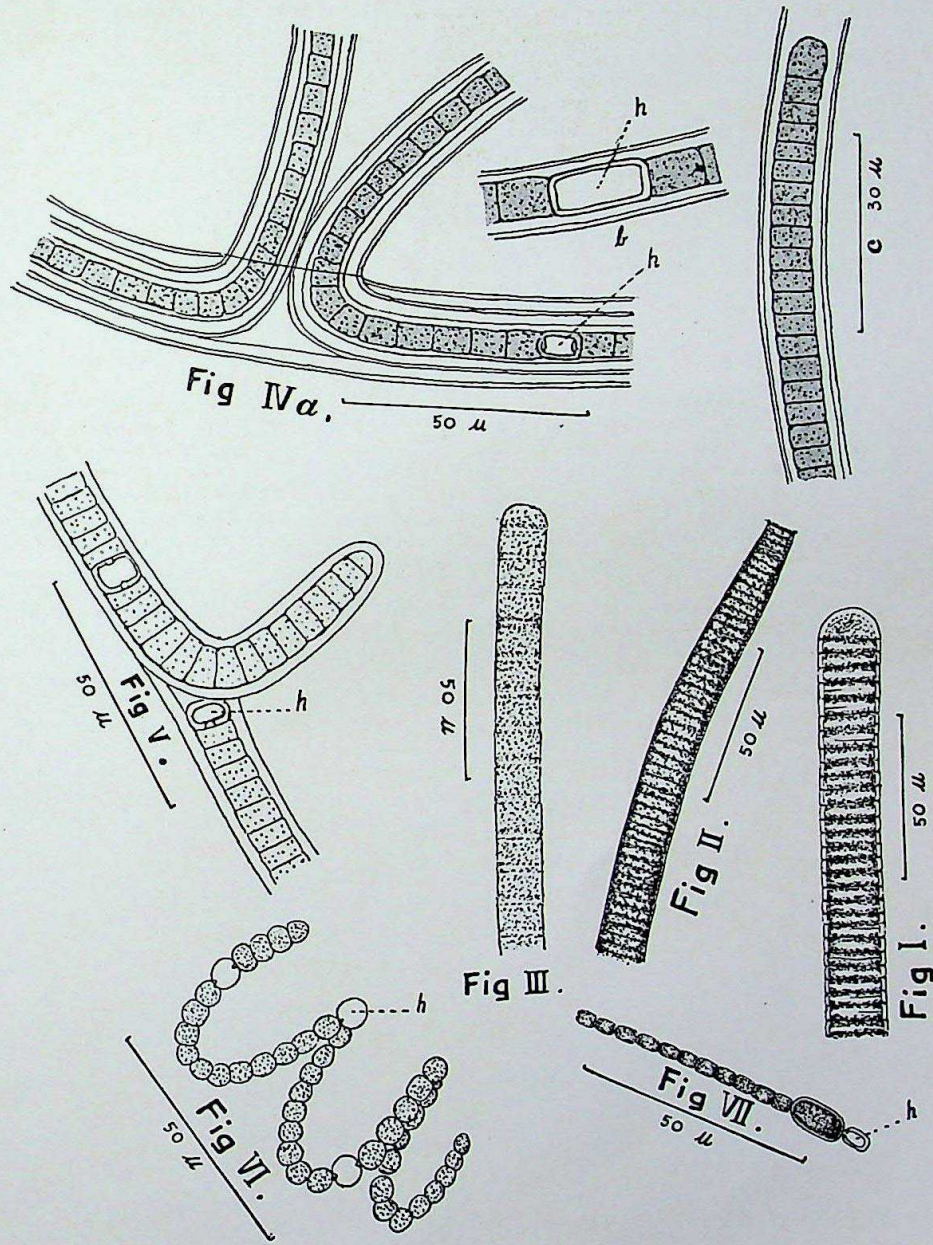

ALGAL FLORA OF HYDERABAD, DECCAN.
(For explanation see text).

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REVIEW.

INDIAN SCIENCE ABSTRACTS (Being an Annotated Bibliography of Science in India). Published by the National Institute of Sciences of India; July 1936; Calcutta. Price, Rs. 7-8.

'Originally the publication was intended to include abstracts of all scientific papers published in India, but at a later date the Council decided also to include abstracts of all papers published abroad on work done in India or based on Indian material.'

An ambitious programme, indeed; and one which for the present has only resulted in the production of a costly publication in which the sins of omission are many and the sins of commission not a few.

The intention, nevertheless, deserves praise; and the get-up is excellent.

J. F. C.

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OBITUARY.

HERBERT MUSGRAVE PHIPSON.
(1850—1936).

The son of Mr. T. W. Phipson, Q.C., of Lincoln's Inn, born 1850, educated at Clifton. Went out to India first in 1878 as a partner in J. A. Forbes & Co., East India Merchants. Established the firm of Phipson & Co., Wine Merchants, in 1883. Married Dr. Edith Pechey, M.D., head physician of the Cama Hospital for Women and Children in 1899. Left India in 1906. Died in London on Tuesday, 7th of August 1936, at the age of 86.

Few Europeans in the Western Presidency, unconnected with its government and administration, have a better claim to grateful memory than Mr. H. M. Phipson and he undoubtedly left this Presidency the richer for his association with it.

The Bombay Natural History Society to whose growth and development he so greatly contributed and the Pechey Phipson Sanitarium for Women and Children at Nasik remain as memorials to his life and work in India.

It is fitting that this *Journal* should firstly commemorate Mr. Phipson's work for the Society. He was in England when the eight original founders of the Society met at the Victoria and Albert Museum, Bombay, on the 15th September 1883. He joined the Society on his return from England in the same year, and in January 1884, offered a room in his offices at 18, Forbes Street, as a more central place for the Society's meetings and for keeping its collections. The removal of the Society's offices to a central situation in the city and Phipson's enthusiastic association with it gave an astonishing impulse to its growth. The need for finding better accommodation for its rapidly increasing collections soon becoming urgent, Phipson again provided the solution by offering the Society part of the larger premises he had acquired at 6, Apollo Street, to which the Society's collections were transferred in 1886 and where its offices still remain. Phipson's interest in Natural History and his zeal for the Society were contagious. He interested his numerous friends in the Society's work and imparted his devotion to the young men who came out to India to assist him in his business. His advice to the young European in India was 'develop a hobby' and to him there was no finer hobby than Natural History. Thus commenced and thus was continued the long association of the Society with the Company which bears Mr. Phipson's name. His successors in business took over his post of Honorary Secretary and Editor of the *Journal* and have each in their time made their contribution to the Society's progress.

From March 1886 when he took over the office of Honorary Secretary from E. H. Aitken, more familiarly known for his books

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H. M. PHIPSON.

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as 'EHA', to April 1906 when he left India, Phipson was the heart and soul of the Society. Originating and directing its early activities he brought it to vigorous maturity. Through these twenty years he edited the Society's *Journal*—for a year in collaboration with Robert Sterndale, then as sole editor for fifteen years and finally in collaboration with Mr. W. S. Millard his immediate successor in office.

His business and his management of the Society's affairs left Phipson little time for contributing in print the wide knowledge he had acquired of Indian Natural History. His favourite branch was Snakes. His rare contributions to the *Journal* centre round this subject, and among the notes he published is a paper on the Snakes of the Bombay Presidency.

Phipson directed his energies to increasing the influence and usefulness of the Society to Zoologists and laymen and to the building up of its collection. So intimately is his name associated with the work that even today the Society's rooms at 6, Apollo Street, are often referred to as 'Phipson's Museum'. In his day Phipson was its presiding genius. He welcomed visitors great and small and taking them round the collections would treat them to a wealth of interesting facts and anecdotes drawn from the wide fund of his knowledge and experience. He was charming: always interesting and ever ready with shrewd and amusing comment. In the early days of the Society various animals, birds and reptiles were kept alive in the Museum. Amongst these was a cobra with which Phipson was on familiar terms. He once turned this cobra out of its blanket and patted its coils to make it sit up and expand its hood before some visitors. The cobra, probably startled, turned and struck at Phipson and buried its fangs in one of his fingers. Phipson displayed his usual coolness in this dreadful situation. His remedy was drastic. He went to the Society's small laboratory adjoining the museum and applied some cyanide of potassium to the wound. Except for some swelling of the finger he fortunately escaped unharmed.

The numerous offers of live animals which the Society was receiving gave Phipson the idea of establishing a Zoological Garden in Bombay, conducted and managed by the Society. What at first seemed a promising venture failed because the Municipality were unwilling to allow the use of the site selected by Phipson for the purpose. In his ambition to provide Bombay with a really fine Natural History Museum, Phipson had succeeded. He early foresaw the necessity for finding suitable and adequate accommodation for the rapidly growing collections of the Society and realised the useful part the Society could play in the establishment of such a museum. An opportunity of accomplishing his objective presented itself when in 1904 he was elected to serve on a Committee appointed by Government to consider the question of a Public Museum and Library for Bombay. At the third meeting of this Committee, Phipson proposed that the Public Museum should take the form of three separate buildings, one for Art and Archaeology, the second for a Public Library and the third for a Natural Science Museum.

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Mr. Phipson's proposals find realisation today in the Prince of Wales' Museum, which is built on the site suggested by him and which now includes a main building for Art and Archaeology and a separate building for Natural History. It would have given Phipson much joy to read the report on Museums in India made at the Conference of the Museums Association held at Leeds this year in which the Natural History galleries of the Prince of Wales' Museum, where the Society's collections are now exhibited, are described as amongst the finest in the world. It is now proposed to name one of the splendid galleries of this museum after Phipson in memory of his association with the work of the Society. His name is also fittingly perpetuated by Zoologists, who named new discoveries after him. These include a new Sea Snake *Hydrophis phipsoni* (*Distira cyanocincta*) described by Murray (*J.B.N.H.S.*, vol. ii, p. 32) and a new earth snake *Silybura phipsoni* described by Mason, *A.M.N.H.* (6), i, 184. In his preface to the Volume on *Arachnida* in the *Fauna of British India Series*, Pocock, the author, acknowledges his indebtedness to Phipson whose influence and energy in obtaining a collection of over a 1,000 scorpions from all parts of India provided the basis for his study. Phipson's association with the work is perpetuated in the various Arachnids Pocock named after him. These include a new scorpion *Isometrus phipsoni* (Pocock, *J.B.N.H.S.*, vol. iii, p. 244), a new Whip scorpion *Phrynicus phipsoni* (Pocock, *Fauna of British India*, Arachnida, p. 127) and a new Galeod spider named *Rhagodes phipsoni* (Pocock, *J.B.N.H.S.*, vol. ix, p. 448). Though the Society's Mammal Survey of India, Burma and Ceylon was taken up long after Mr. Phipson's departure from India, Oldfield Thomas, who described many of the new species discovered by the Survey, named a beautiful Flying Squirrel in honour of Mr. Phipson 'to whose initiative and enthusiasm the Society owes so much of its prosperity and to whose ready help most Indian Zoologists have at various times been greatly indebted'. Few men have striven more earnestly, more continuously to advance a purely unselfish cause and few have laboured for the advancement of Science and for the general good in a more self-effacing and unobtrusive spirit. Phipson was always ready to help anyone, and, as one friend with whom he lived said:—'He monopolized the self-denial of the whole house!' This was the key to the character of the man and to his life of service. He was for many years the Honorary Secretary of the Bombay Branch of the Countess of Dufferin's Fund and in 1885 and 1887 organised two fancy fair fetes which added a substantial sum to the fund, when the late Lady Reay was the President of the Bombay Branch. Among other activities which will commemorate the name of Phipson and his wife is the Pechey Phipson Sanitarium for Women and Children at Nasik, Deccan. The institution was founded by them to enable poor women and children in Bombay to recuperate in the bracing air of the Deccan after illness and it now consists of twenty-one cottages, with a hostel for working girls. It is open to all communities.

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MISCELLANEOUS NOTES.

I.—ASSOCIATION BETWEEN A LEOPARD AND A TIGRESS.

I had the good fortune of witnessing a very strange association between a large leopard and a full-grown tigress. An instance of animal companionship which is surely given to very few sportsmen to see.

I was invited by my maternal uncle, His Highness the Nawab Sahib of Tonk, to a tiger shoot in one of his very large detached territories in Central India known as Seronj. The Vindhya Range runs through the heart of this pargana, and the scene of occurrence lay in one of its very lovely reserved forests called Samalkheri. The story related by the shikaris was that in these forests there was a large leopard which always killed the bait, and that a tigress waited and took part in eating the kill. The story sounded improbable. To discover what truth there was in it I obtained permission from His Highness to try and bag both the tigress and her supposed mate the leopard.

On the night of the 25th of March, 1936, I sat up to watch. A young buffalo was tied out as a bait. The sun had hardly set when I heard the 'sawing' of the leopard and the long drawn moan of the tigress. It seemed as if both were in the same place. A little later a sambhur belled and langoors began to swear as the felines passed beneath them. All was again quiet, and not till the sun had set and it was fairly dark did I hear the bait jump up and try to break loose. The next instant from the thick bushes like a streak of lightning the leopard sprang upon the bait and a struggle ensued. The leopard being a very large one was capable of mastering and killing the buffalo. All the time the tigress sat in the open watching her mate kill the bait. When all was over both sat side by side and devoured the kill. I was terribly excited at this sight; and with the greatest difficulty refrained from firing. I made up my mind to see whether this extraordinary performance would be repeated and to give myself another opportunity of watching it. The next day another bait was tied out but no kill took place. The following morning it was observed that the leopard and tigress had both passed close to the bait but did not kill. I was afraid that both had left the locality, and that I had also missed the chance of shooting a couple of such fine animals. The subsequent evening I sat up again, and exactly the same thing occurred. The leopard killed and the tigress, who took no part in the killing, shared the meal. Again I did not shoot. They killed every second night, and, in preparation for the next kill, I had a larger bait tied out to see as to whether the leopard would attack it or leave it to the tigress to kill. The leopard hesitated a bit this time but launched the attack as usual. The bait drove off the leopard. The attack was repeated with renewed vigour and this time the leopard got home, but the buffalo in floundering and jumping

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managed to fling off its assailant. Seeing her mate incapable of mastering it, the tigress attacked and killed the bait. Both again on the friendliest of terms devoured the kill. I left them in peace and returned home after they had left the kill. I sought an explanation of this strange association as to why this particular leopard and tigress lived in such intimacy. The only feasible thing that I could think of was that the leopard was a hybrid. This theory proved to be wrong as the leopard after being shot proved to be nothing more than a leopard of exceptional size. The next day I made up my mind to have a beat, and His Highness very kindly let me have the best machan. The beat began and very soon the tigress appeared. She tried to escape by a side nullah, but was turned by a stop. She came to within sixty yards of my machan when I fired hitting her just behind the shoulder. She gave a bound but fell dead to a bullet from my ·375 Holland and Holland magnum rifle. A few minutes later the leopard appeared, and when quite close was shot by my brother-in-law, His Highness the Nawab of Baoni. The tigress measured 8 ft. 3½ in. and the leopard 7 ft. 10½ in. between pegs.

Thus ended a very extraordinary and strange friendship between a tigress and a leopard. Both animals were in the soundest condition and no signs of any kind of previous crippling wounds were found on either of them.

PUNJAB. IFTIKHAR ALI KHAN,
July 3, 1936. *Heir Apparent of Malerkotla State.*

[It is difficult to explain the curious association between this leopard and tigress—except to suggest that it may be an instance of mating between the two animals. When the two species occupy the same territory, normally, there is acute rivalry between panthers and tigers on the question of food and there are numerous instances of panthers being killed by tigers in disputes over a kill. In the present instance a complete understanding apparently existed between the two animals, not only in the matter of killing prey, but equally in the division of the spoils. The natural disposition to rivalry between the two animals could have been overcome only by the sexual urge which draws animals of the same species into association—temporary or permanent and which in the present instance may have drawn together two different, though allied species. Under conditions of captivity the great cats, lions, tigers, leopards and jaguar have frequently interbred. We have instances of lions and tigers interbreeding—the most recent being the 'Liger' a cross between a lion and tiger which the Society was instrumental in sending some years ago to the London Zoo. In 1912, we sent a skin of a hybrid lion-leopard to the British Museum—the result of the mating of a large male leopard and lioness in the Kholapur Zoo. A male lion is also recorded as having bred in Chicago with a female, which itself was a cross between a jaguar and a leopard. Opportunities for such interbreeding under natural conditions must be rare but the note under discussion suggests their possibility.—EDS.]

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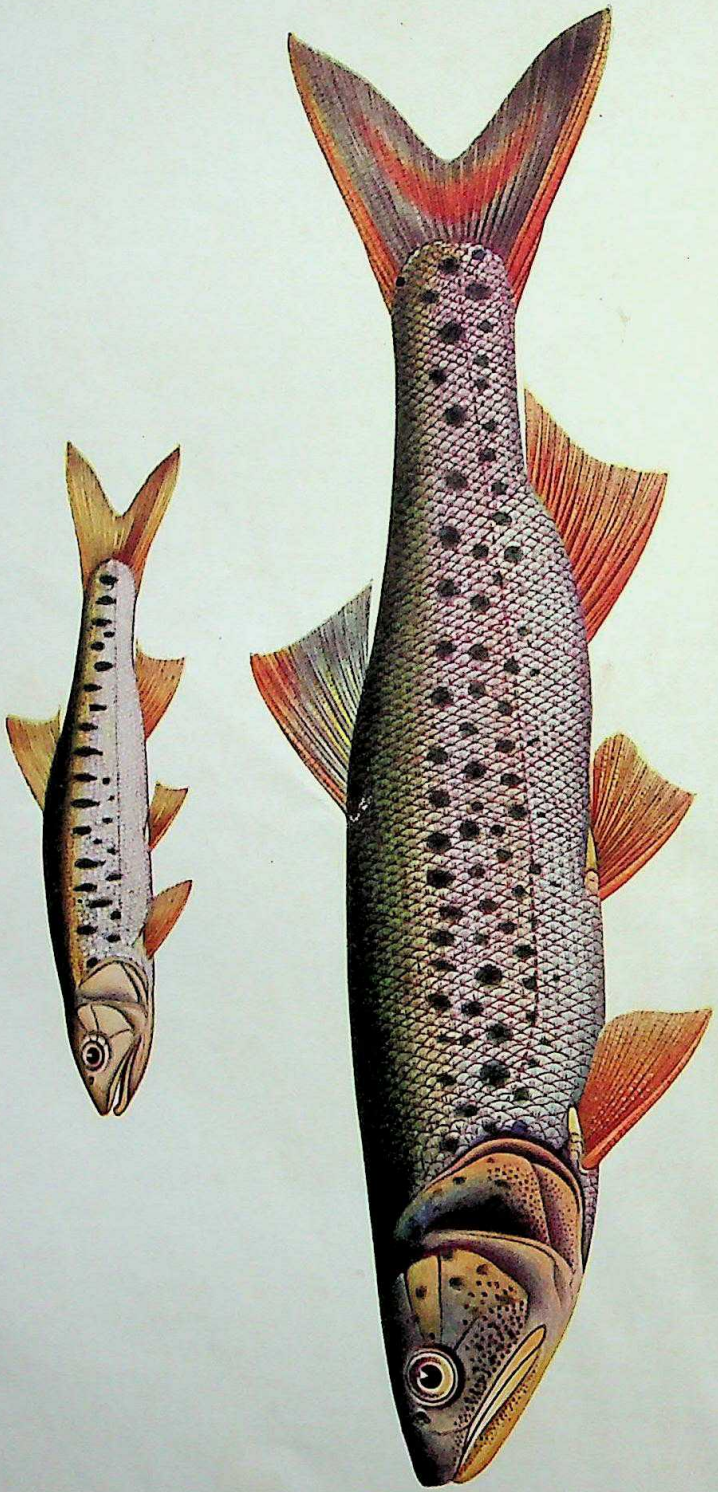

THE INDIAN TROUT
Barilius (Opsarius) bola Hamilton

JOURN. BOM. NAT. HIST. SOC.

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JOURNAL
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APRIL 1937. VOL. XXXIX. No. 2.

THE GAME FISHES OF INDIA.[1]

BY

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(With one plate and 3 text-figures).

PREFATORY NOTE.

For a number of years the Editors have been urging me to contribute to the Society's *Journal* a series of articles on the Game Fishes of India on the model of Mr. Stuart Baker's excellent series entitled 'The Game Birds of the Indian Empire'. Unfortunately the taxonomy of Indian fishes, especially of the freshwater forms, is in a state of great confusion and in some cases it is not even possible to define the precise generic and specific limits of the commonest forms, such as *Mahseer*, without a great deal of preliminary spade work. As enquiries are very often made regarding the habits and habitats of these fishes, it has been considered desirable to start the series, giving as much information about each species as is available. It is hoped that these articles will induce anglers and others interested in the subject to contribute their experience to the pages of the *Journal*, so as to enable us to have a better knowledge of these valuable fishes.

In writing up this series I shall first of all deal with forms of which I can easily obtain coloured sketches or about the taxonomy of which there does not appear to be much confusion. The order of the treatment of the various species will, therefore, not be in accordance with the systematic position of these forms.

I.—'THE INDIAN TROUT'.

BARILIUS (OPSARIUS) BOLA HAMILTON.

CONTENTS.

	PAGE
Introduction	200
Taxonomy	
Nomenclature	200
Systematic Position	204
Description and Distribution	204
Measurements	206
Bionomics and Fishing Notes	206
List of References	209

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Introduction.

The fondness of the Europeans for Trout-fishing is so great that even in India where no true Trout (Family: Salmonidae) existed before their advent, as a result of persistent efforts, two or three varieties of trout have now been introduced. Loch Leven Trout (*Salmo levenensis*) was the first to be imported and acclimatised into the Nilgiri Hills in the seventies of the last century (**9**).[1] Since then true Trout have been introduced into several other localities along the Himalayas where their culture is proving a great success. It may be remarked that in their natural state the nearest locality to India where they exist is the northern slope of the Hindu Kush in Afghanistan (**15**). There are in Northern India certain species of Carp which resemble true Trout either in form, lepidosis, colouration or sporting qualities and for these reasons they are commonly called 'Trout'. Such fishes include the 'Indian Trout',[2] known in scientific literature as *Barilius bola* Ham. The origin of the popular name and the relative qualities of the fish are thus described by Thomas (**23**):

'I have called it the Indian Trout, because it is commonly thus called in Northern India. Other competitors there are for the name; but *Barilius bola* seems to have the best title to be called the Indian Trout. To avoid confusion, therefore, we will commence by deposing the other fish which seem to have less right to the honourable distinction. *Oreinus richardsonii* has, according to Day, been called the "Kemaon Trout". "In some specimens there are black spots on the sides and head." Of *Oreinus sinuatus* Dr. Day writes in his *Fishes of India*, "some have scattered black and occasionally red spots, and these have been termed Trout". But this fish has a sucker with which it adheres to rocks, which is most untroutlike, and Dr. Day tells me it will not take a fly at any price, a piece of wrong-headedness for which, with your concurrence, it should be shorn of its brevet-rank, in spite of its red spots. *Oh formose puer nimium ne crede colori*—we will degrade you in spite of your looks. "Handsome is that handsome does" is the better rule, and as *Barilius bola* sports like a trout, as we shall see, let us allow his claim, though he has no adipose dorsal fin like the true trouts (Salmonidae). We may have the less hesitation in confirming the honorific as there are no indigenous trout in India.'

All along the Himalayas the small-scaled Barbels of the genera *Schizothorax* and *Oreinus* (Schizothoracinae) are sometimes termed 'Trout', but with these fishes we shall deal sometime later. Reference may, however, be made to the fact that there is a great superficial similarity between the Schizothoracinae and the Salmonidae and that the features of resemblances between them have been independently acquired under the stress of similar environmental conditions—rapid-running water over a rocky bed (**1**).

Taxonomy.

Nomenclature.

As is unfortunately the case with a number of our well-known Game Fishes, such as *Mahseer*, the taxonomy of the 'Indian

[1] Numerals in thick type within brackets refer to the serial numbers of the various publications listed in the bibliography at the end of the paper.

[2] In some parts of India, especially the Eastern Himalayas, this fish goes by the name of 'Hill Trout'.

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Trout' is also involved in a great confusion. It was originally described by Hamilton (**13**) in his second division of *Cyprinus* which he termed *Barilius* and defined as follows:

'Fishes of the genus *Cyprinus,* with the body very long and much compressed; with the sides irregularly marked with numerous incomplete transverse bars or spots; with the back fin placed considerably behind the middle of the fish; and with one lateral line at least running parallel to the lower edge of the fish.'

He further observed that

'The fishes of this division, on account of the numerous spots or marks on their sides, have a considerable resemblance to our Trout, and, by the English in Bengal, some of them have been considered as belonging to that genus; but they have only one fin on the back.'

Among the species included by Hamilton under *Barilius* are: (1) *Cyprinus barila*, (2) *C. chedrio*, (3) *C. barna*, (4) *C. vagra*, (5) *C. bendilisis*, (6) *C. shacra*, (7) *C. cocsa*, (8) *C. chedra*, (9) *C. tila*, (10) *C. bola*, (11) *C. goha* and (12) *C. tileo*. The majority of the species in this group are of little value, but in the case of *C. goha* Hamilton says:

'I have found this fish in the Kosi, Yamuna, and Son rivers, where it is called a *Trout* by the English. It grows to about the size of a herring, and is a fine flavoured delicate fish, somewhat resembling in taste the *Smelt* of Europe.'

Though Hamilton published the drawings of only two species of *Barilius—Cyprinus bendilisis* (**4**) and *C. cocsa* (**13**)—very fortunately there are drawings of seven other species in his collection of MS. drawings (**14**) now preserved in the library of the Royal Asiatic Society of Bengal. Of these MS. drawings, three were published by Gray (**11**) and five by McClelland (**20**), while two species—*C. chedrio* and *C. tila*—did not have any illustrations. It is beyond the scope of this paper to discuss the precise specific limits of all the species enumerated above, but it may be indicated that certain authors (**9**, **12**, **17**) have regarded *C. bola* and *C. goha* as conspecific, while some others (**2**, **5**, **6**, **20**) have considered them as separate species. The conflicting views on this point may now be elucidated.

Of *C. bola* Hamilton says, 'It grows to four or five inches in length, and is little valued.' He found this species in the Brahmaputra 'with many oblong diffuse spots, and a longitudinal golden stripe on each side.' His *C. goha* is provided 'with many diffuse scattered spots on the sides', and grows to a much larger size. 'In other respects it has the closest resemblance to the *Bola* just now described; and I have only in addition to state, that the spots on the sides of the *Goha* are more numerous, more irregularly scattered, and rounded than those on the *Bola.*' These observations are fully borne out by his drawings of the two species.

Authors, who had series of specimens of these forms for examination, came to the conclusion that *C. bola* merely represents the juvenile stage of *C. goha*. Mukerji and I (**17**) recently studied this fish in its natural surroundings in the Dehra Dun hills and showed how the colour varies with age. In the colour drawings of the two Dehra Dun specimens reproduced here the juvenile

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and the adult colouration are clearly brought out. These show conclusively that Hamilton's two species must be regarded as conspecific. As *bola* is described before *goha*, it has priority over *goha* for the purpose of scientific nomenclature and this is why the 'Indian Trout' has been known as *Barilius bola*. After Hamilton, McClelland (**20**, pp. 297, 298, 419, 420) referred to these fishes but placed them in a new genus *Opsarius* along with a very diversified group of species. The genus was characterised as follows:

'Mouth widely cleft, body slender, and usually marked with transverse green streaks or spots, dorsal small without spine, and placed behind the middle, anal long, lower margin of the body more arched than the upper.'

'Obs. Intestine very short, and extends almost straight from the stomach to the vent.'

He made some observations on the morphology and bionomics of the fishes of this composite genus, and described Hamilton's *C. goha* as *Opsarius gracilis* and *C. bola* as *O. megastomus*. Of the latter he had no specimen for examination and referred to its characters as given by Hamilton; while the former—the *Korang* of the Assamese—is described in some detail. Concerning this species McClelland remarks:

'This species occurs in all parts of Assam, in the Kosi, the Jumna, the Ganges and the Soane rivers; in which last Buchanan says it attains the size of a Herring, and is called Trout by the English, chiefly from the spots on the sides, and its fine flavour. For the latter I cannot answer; but as the species of this group are not much esteemed by the natives, I suspect it owes its imagined sweetness, in some degree, to its supposed resemblance to Trout. Notwithstanding the beauty of its appearance, its habits are such as to render it very objectionable in fish ponds.'

Both Cuvier and Valenciennes (**6**) and Bleeker (**2**) referred to Hamilton's two species as distinct forms, but they had no specimens for examination.

In 1858, Blyth (**3**) described *Leuciscus salmoides* from Allahabad and defined it as follows:

'Affined to *L. goha* (*Cyprinus Barilius goha* B.H., v. *Opsarius gracilis* McClelland); but larger and deeper in the body, with the spots smaller, much more numerous, and more regularly disposed, many of them occurring below the lateral line, and others on the opercula and praeopercula: upper lip studded with pores.

D. 10; A. 13; P. 14; V. 9; C. 18.

Lateral line composed of 88 to 90 scales; and oblique series of 26 scales descending from anterior base of dorsal. Length of specimen 11 in.'

The larger specimen figured here from the Dehra Dun hills possesses all the special features noted by Blyth for his species, and is about 11 inches in length. But there can hardly be any doubt about its identity with Hamilton's species.

Steindachner's (**22**) description of the 'Indian Trout' is based on young specimens from 5 to 7 inches in length and his determination of the species as *Barilius goha* is based on Gray's drawing (**11**) in the *Illustrations of Indian Zoology*.

Günther (**12**), who examined young, half-grown and adult specimens of the species, was the first to combine Hamilton's two species into one and on account of its very wide mouth, extending beyond the eyes, he separated it into a new genus *Bola*

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and designated the fish as *Bola goha*. Except for the width of the mouth there is no other special feature in which his genus differs from *Barilius*. He also indicated that *Opsarius* McClelland (in part) is a synonym of *Bola*. Day (**7**) pointed out that *Bola* Günther is 'preoccupied by Genus VI in Hamilton Buchanan's *Fishes of the Ganges*, p. 73', and instead revived *Opsarius* McClelland to accommodate Hamilton's *Cyprinus goha*. In his later works, however, Day (**9**, **10**) did not consider this species generically distinct from other members of the genus *Barilius*, and accordingly regarded *Opsarius* McClelland as a synonym of *Barilius*.

In 1918, however, Jordan (**18**) proposed the name *Raiamas* as a 'substitute for *Bola* Günther, 1868, preoccupied by Hamilton' and designated *Cyprinus bola* Hamilton as the type of the genus. Evidently he was not aware of the fact that Day (**7**) had already restricted the use of *Opsarius* McClelland for *Bola* Günther. In his *Genera of Fishes* he (**19**) noted that *Opsarius* is 'apparently a synonym of *Barilius* Ham.' Chaudhuri (**5**), without looking properly into the contention of Jordan, revived the generic name *Bola* and erroneously regarded *C. bola* and *C. goha* as distinct species. Mukerji and I used the generic designation *Raiamas* in recording the 'Indian Trout' from the Dehra Dun hills, without looking into the past changes in the nomenclature of the species. If it be conceded that *Cyprinus bola*, with *C. goha* as a synonym, should be regarded generically different from other species of *Barilius* on account of its very wide mouth then its proper scientific title should be *Opsarius bola* (Hamilton), but the question whether *C. bola* is generically distinct from the other known species of *Barilius* still remains to be elucidated.

A glance at Day's figures of the various species of *Barilius* described in the *Fishes of India* (pls. cxlviii; cxlix; cli, fig. 2) shows that the extent of the mouth is a very variable character in this genus. In *B. guttatus* (Day) from Burma the cleft of the mouth is deep and extends for a considerable distance behind the eye. The suborbitals are also very broad, 'more especially the hindermost which is nearly behind the vertical from the posterior margin of the orbit, and almost covers the cheek.' In these respects the species agrees very closely with *B. bola* and was originally described under the generic designation *Opsarius* (**8**). In *B. tileo*, *B. gatensis*, *B. bakeri*, *B. modestus* and *B. vagra* the posterior extremity of the maxilla extends to beneath the middle of the orbit and the suborbital bones cover a considerable part of the cheek. In *B. bendilisis*, *B. barila*, *B. canarensis* and *B. barna* the posterior extremity of the maxilla reaches to below the anterior third of the orbit, while in the remaining species—*B. evezardi*, *B. shacra* and *B. radiolatus*—the maxilla just reaches the margin of the orbit. It is clear from the above that though no generic importance can be attached to the extent of the mouth, the condition in *B. guttatus* and *B. bola* is sufficiently characteristic to warrant their inclusion in a separate group within the genus *Barilius*. I, therefore, propose to call the 'Indian Trout' *Barilius* (*Opsarius*) *bola* Ham.

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Systematic Position.

The genus *Barilius* belongs to the sub-family Rasborinae of the family Cyprinidae, usually known as Carps (Order: Ostariophysi; Sub-order: Cyprinoidea). In the fishes of this family the head and the body are usually compressed and, except in a few cases, the pectoral and the ventral fins are inserted along the sides and possess only one simple ray. There is no spine below the eye which has a free orbital margin or a gelatinous eyelid. The mouth is inferior or terminal; its upper border is formed by the premaxillaries only. There are never more than two pairs of barbels. The body is covered with scales and the lateral line is generally complete. The pharyngeal teeth are present in one, two or three series. The air-bladder is usually large and free in the abdominal cavity.

In the Rasborinae the abdominal surface is not compressed into a sharp edge. As a rule, the lower jaw is provided with a symphysial knob, fitting in an emargination of the upper jaw. The dorsal fin is without an osseous spine and is situated behind the ventrals. The lateral line abruptly bends downwards and, when complete, runs along the lower half of the tail.

The members of the genus *Barilius* are characterised by their compressed snout and anterior mouth. Moreover, they usually possess spots or vertical bars on the body. In the sub-genus *Opsarius*, as indicated above, the cleft of the mouth extends beyond the eye. Besides the 'Indian Trout', there is only one other species—*B.* (*Opsarius*) *guttatus* Day—which possesses this character; it is found in Burma and possesses 44-48 scales along the lateral line (*versus* 88-94 in *bola*).

Description and Distribution.

Barilius (Opsarius) bola Hamilton.

The Indian Trout.

Vernacular names.—*Buggah* (Orissa); *Korang* (Assam); *Bola* (Bengal); *Buggarah* (Hindi); *Goha* (Purniah Dist.); *Bhola Goalpara, Na-laida* (Mechi); *Gulabi Machli* or rose-speckled fish.

B. iii; D. 3/7-8; A. 3/10; P. 13; V. 9; C. 19; L. l. 88-94; L. tr. 12-15/9-11.

Barilius bola possesses the characteristic Trout-like form; its dorsal profile is scarcely arched, while its ventral profile is somewhat convex. The head and body are greatly compressed: the former is sharply pointed. The length of the head is contained from 4.3 to 4.6 times in the length without the caudal. The head is proportionately smaller in the younger individuals. The width of the head is considerably greater than the width of the body and is contained from 1.9 to 2.3 times in the length of the head; the height of the head is contained from 1.5 to 1.6 times in the same dimensions. The depth of the body is contained from 5.4 to 5.7 times in the total length and from 4.3 to 4.6 times in the length without the caudal. The caudal peduncle is well

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formed; its least height is contained from 1.5 to 1.9 times in its length; in smaller individuals it is proportionately deeper.

The eye is situated slightly below the level of the dorsal profile and entirely in the anterior half of the head. In adult specimens the mouth opening extends about 1½ diameters of the eye behind the posterior margin of the orbit. The eye is proportionately much larger in the younger individuals; its diameter is contained from 5 to 7 times in the length of the head, from 1.4 to 2.1 times in the length of the snout and from 1.1 to 1.9 times in the interorbital width. The interorbital space is more or less flat. In some adult specimens the snout and cheeks are covered with 'pearl-organs'[1] and there are also tubercles on the dorsal surface of the anterior rays of the pectoral fin in single rows. The lower jaw is also covered with sharply pointed tubercles. Such specimens agree in every respect with Blyth's description of *Leuciscus salmoides* (*vide supra*, p. 202), and in my opinion represent the males of the species. Sufficient material is, however, not available to elucidate these sex differences. The mouth is very wide and obliquely directed upwards. The upper jaw is longer than the lower and is deeply notched in the middle to receive a very prominent knob of the lower jaw. The suborbital ring of bones is very wide, especially the third which in adults is as wide as the distance between its hind border and that of the operculum. The barbels are altogether absent. The scales are very small. The lateral line is curved anteriorly and then it is continued to the lower half of the base of the caudal fin.

The dorsal fin commences somewhat behind the anterior origin of the ventral and its free edge is only slightly curved; its commencement is equidistant between the anterior margin of the orbit and the base of the caudal fin in young specimens while in the adults it is midway between the posterior margin of the orbit and the base of the caudal fin; it is considerably higher than long. The pectoral fin is almost as long as the head behind the eye and is separated from the ventral by a considerable distance; its outer rays are the longest, and there is a scaly appendage in its axil. The free border of the ventral fin is concave in the young specimens, while in the adult males three of the inner rays are somewhat produced so that they form a regular lobe; these elongated rays are probably used for clasping during copulation. The caudal fin is deeply forked with both the lobes equal and pointed.

In young individuals the colouration is much lighter than that of the adult. The back is greenish-gray and this is separated from the silvery portion below by a longitudinal golden stripe. The fins are yellow. The greenish-blue spots on the sides are oblong and their number in a specimen about 13 cm. in total length varies from 15 to 17. In between these spots, at a somewhat lower level, there are indications of a second series of spots. The middle portion of the lower lobe of the caudal as well as its posterior margin are grayish. With the growth of the fish the colours

[1] The term 'pearl organs' is used for the cornifications of the skin which take the form of small tubercles; these appear chiefly on the head of various Cyprinoid fishes at breeding time.

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become much deeper and the yellow is replaced by orange. The spots become rounded and are irregularly distributed in many rows. In fully mature specimens they also occur on the preoperculum, the suborbital bones and the operculum. Day's description of the colouration of a fairly grown-up specimen is as follows:

'Silvery with two or more vertical rows of bluish blotches along the sides, the upper being about twelve to twenty, and the lower intermediate; some spots also on the head. Lower half of the dorsal fin slightly gray. Caudal orange, stained with gray and black. Pectoral, ventral and anal orange, the colours being somewhat similar to those of a trout.'

A colour drawing of the species was published by Spence and Prater (21) based on the drawing and description by Day in his *Fishes of India*. The specimens, of which the drawings are reproduced here, were collected by me from the Song River near Lachhiwala in the Dehra Dun District. Unfortunately no notes on colouration were taken in the field, but the details have been filled from the original drawings of the species prepared by Hamilton over a century and a quarter ago. These drawings are beautifully prepared and well preserved. The author has left notes to the effect that he always had them coloured from living specimens.

Distribution.—Barilius bola is confined to the hilly parts of the Punjab, United Provinces, Bihar, Orissa, Bengal, Assam and Burma. Day records that it grows to about a foot in length, but mentions that 'one killed in Assam by Mr. Hannay is stated to have weighed 5 lbs.' Usually it weighs under 2 lbs.

Measurements in millimetres.

Total length including caudal ...	107·0	130·0	285·0	286·0
Length of caudal ...	22·0	28·0	55·0	55·0
Depth of body ...	19·0	23·0	50·0	53 0
Width of body ...	10·0	11·0	24·0	29·0
Length of head ...	23·0	29·5	65·0	65·5
Width of head ...	12·0	15·0	28·5	32·0
Height of head at occiput ...	15·0	19·0	41·5	41·0
Length of snout ...	6·3	9·0	18·0	19·0
Interorbital width ...	5·0	8·0	17·0	18·0
Diameter of eye ...	4·5	6·0	9·3	9·3
Longest ray of dorsal ...	15·0	18·5	39·0	39·5
Longest ray of anal ...	13·0	17·0	34·0	35·0
Length of pectoral ...	15·0	19·0	41·0	41·0
Length of ventral ...	11·5	14·0	32·0	32·5
Length of caudal peduncle ...	14·0	17·0	41·0	41·0
Least height of caudal peduncle ...	9·0	10·0	22·0	22·0
Length of maxilla ...	13·0	17·0	37·0	37·0

Bionomics and Fishing Notes.

Thomas (23), on the authority of his several correspondents and personal experience, has given copious notes regarding the

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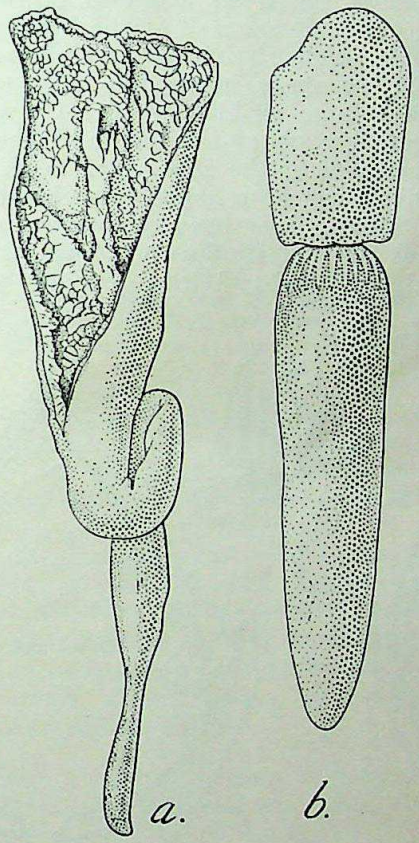
habits, habitat, occurrence in various localities and the type of rod and tackle required to deal with this fish. Those desirous of obtaining full details may consult this invaluable work in original.

The 'Indian Trout' is found in many rivers of Northern India where it lives in clear streams with rocky beds. Generally it prefers junctions[1] of streams or rapids at the head of pools. In such situations it preys on smaller fish and is thus very destructive to fisheries in general. I have also found remains of insects (of a dragon fly) inside the stomach of one of the individuals collected in the Song River. Its wide mouth and stream-lined body are admirably adapted for a predacious life and the form and structure



Text-fig. 1.—Alimentary canal and air-bladder of *Barilius* (*Opsarius*) *bola* Ham. Nat. size. From a specimen about 11 in. in total length.
a. Alimentary canal: anterior part of stomach is cut open to show the nature of its internal wall; *b*. Air-bladder.

of its alimentary canal (fig. 1*a*) leave no doubt that it is a highly carnivorous species. McClelland (**20**) noted:

'The stomach is equal to about half the entire length of animal, and the intestine from the stomach to the vent only about half the length of the

[1] The advantages of such a habitat were pointed out by me in the account of 'Fish of Chitral' (**16**).

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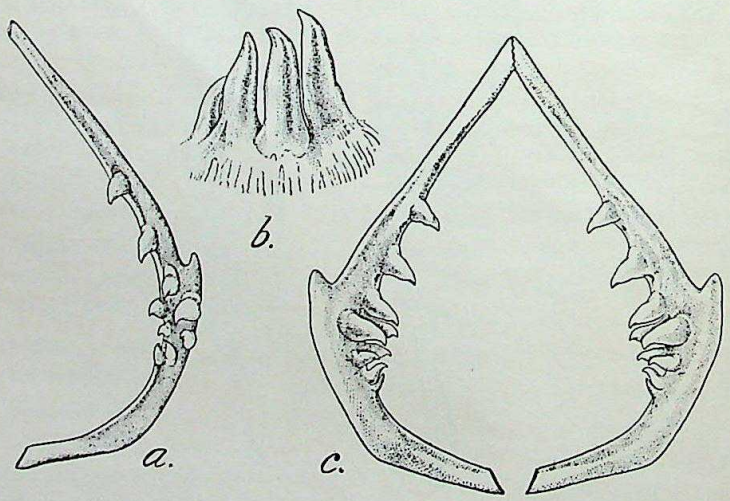
stomach itself, and separated from that organ, which it rivals in capacity, merely by a stricture.

'The liver and other large glands whose functions are supposed to facilitate digestion are extremely small in this species, though it is possessed of an insatiable carnivorous appetite; nor have I found in Cyprinidae, in general, those glands bear any proportion to the size of the stomach, or the nature of the food in different species.'

The inner surface of the stomach is raised into folds running in various directions (fig. 1*a*) which help to increase the glandular area meant for the secretion of the gastric juice. The liver, though short in the anterior region, extends along the stomach as noted by McClelland in his general account of the genus *Opsarius*. This peculiar disposition of the liver, and also of the kidneys, which extend along the entire dorsal wall of the body cavity, is brought about by the compression of the body which has resulted in the great reduction of the space inside the body cavity. Moreover, *B. bola* possesses a large air-bladder (fig. 1*b*) which is long and narrow but extends throughout the length of the abdomen. This indicates the importance of the air-bladder in the economy of life of this species which has been sometimes observed to swim near the surface with a part of its head almost out of water.

The pharyngeal teeth of *Barilius bola* (figs. 2 and 3) are sharp at the distal end and produced into a point; the distal portion



Text-fig. 2.—Pharyngeal bones and teeth of an adult specimen of *Barilius* (*Opsarius*) *bola* Ham.

a. Pharyngeal bone and teeth from the inner side, $\times 2\frac{2}{3}$; *b*. Some of the pharyngeal teeth magnified to show their form, $\times 4$; *c*. Pharyngeal bones and teeth in their normal position, $\times 2\frac{2}{3}$. From a specimen about 11 in. in length.

is somewhat curved so that the form is blade-like. Such types of teeth are undoubtedly meant for tearing up prey or holding it firmly during ingestion. In the young specimens the teeth

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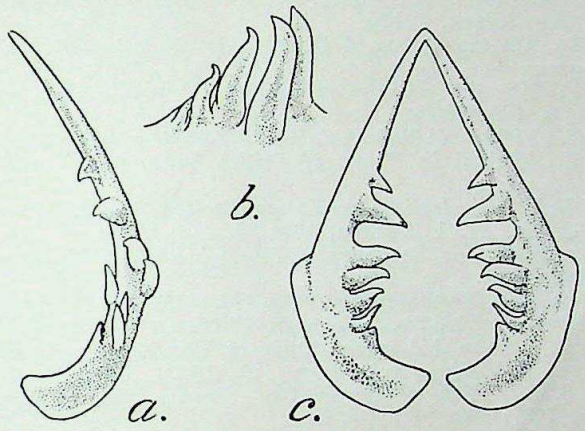
(fig. 3) are more slender and the outermost row contains only 4 teeth (4.3.1), while in the adult condition there are 5 teeth in the outermost row and the teeth are somewhat more massive.



Text-fig. 3.—Pharyngeal bones and teeth of a young specimen of *Barilius* (*Opsarius*) *bola* Ham.
a. Pharyngeal bone and teeth from the inner side, ×8; *b*. Some of the pharyngeal teeth magnified to show their form, ×12; *c*. Pharyngeal bones and teeth in their normal position, ×8. From a specimen 4·2 in. in length.

According to Day, 'It is a very game fish, takes the fly well, and is one of those termed *Rajah mas*, or "chief of the fishes" in the Assam rivers.' In the Dehra Dun hills another species of *Barilius*, *B. bendilisis* Hamilton, is used as a bait for the 'Indian Trout'.

The 'Indian Trout' is usually fished with a fly, a small spinning bait, or tiny spoon. 'A small fly with white wings, is, perhaps, best. On being hooked, it jumps repeatedly out of the water and rushes about furiously, fighting gamely to the last. The lightest ten-feet fly rod is recommended with extra fine gut casts.'[1]

So far as I am aware, no information is available regarding the breeding habits of the Indian Trout.

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Explanation of Plate.

Lateral view of a young and an adult specimen of the Indian Trout, *Barilius* (*Opsarius*) *bola* Hamilton. $\times \frac{3}{4}$.

The specimens were collected from the Song River near Lachhiwala in the Dehra Dun District, United Provinces.

(To be continued).

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THE MONGOOSES OF BRITISH INDIA, INCLUDING CEYLON AND BURMA.

BY

R. I. POCOCK, F.R.S.

(From the Zoological Department of the British Museum, Natural History).

(With 2 text-figures).

INTRODUCTION.

Blanford assigned the Mongooses of these countries to eight distinct species. Wroughton, however, in his revision increased the number to nine. He followed Thomas in uniting *fulvescens* (=*flavidens*) with *fuscus*, giving it subspecific rank, but he resuscitated *nepalensis*, which Blanford quite correctly regarded as a synonym of *auropunctatus*, and he gave a new name, *lanka*, to the Ceylonese form of the so called common Indian Mongoose, although Blanford, again correctly, regarded the two as referable to the same species. Thomas and Wroughton, however, with the splendid material of Mongooses collected by the Mammal Survey in their hands were mainly interested in the local races, or subspecies, into which most of the genuine species proved to be divisible. In conjunction with Miss Ryley, they introduced a considerable number of new names for these minor subdivisions; but too little attention, if any, was paid to the frequently well marked variations in the coat and colour according to season, with the result that some of the alleged subspecies were based upon characters due to this phenomenon. In the two most recent works upon the Mongooses of these countries of the Oriental Region, namely Mr. W. W. A. Phillips's *Manual of the Mammals of Ceylon* and Mr. S. H. Prater's account in Part IV of 'The Wild Animals of the Indian Empire' [*J.B.N.H.S.*, xxxviii, Pt. II, pp. 149-55 (1936)], the authors very naturally adopted Thomas's and Wroughton's opinions.

The following account of these eastern Mongooses is based upon an examination of all the skins and skulls in the British Museum, including the valuable series, with full particulars regarding date, locality and sex, collected by the Survey. The net result is the admission of only six distinguishable species of Mongooses (*Herpestes*) and a reduction in the number of subspecies into which some of them are divisible. There are also a few changes in nomenclature. The reasons for these and for my dissent from some of the conclusions of my predecessors are fully given under their appropriate headings. As in other papers on British Indian Carnivora published in this *Journal* I have purposely put on record a large number of details connected with individual specimens obtained by the collectors who worked for the Mammal Survey of India. The vast number of specimens that was secured leaves the impression that Mongooses of one kind or another are the dominant Carnivores of British India. But the original home of the family was probably Africa where it is represented by several well defined

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genera, including *Herpestes*, which is also found in Spain. Generic names were introduced, principally by Gray, for most of the Indian species; but it seems preferable to retain them provisionally in *Herpestes*. These generic names are mentioned under their appropriate headings. Their typical species were selected by Thomas [*Proc. Zool. Soc.* (1882), p. 63].

Key to the British Indian Species based on external characters.

A. A conspicuous stripe on the side of the neck; tail about two-thirds the length of the head and body.

1. Neck-stripe black, extending from behind the ear and composed of soft underhair; hind foot naked to heel; tail-tip black; chin and forethroat dark; contour hairs typically extensively red at tip ... *vitticollis.*

2. Neck-stripe white, extending from corner of mouth and composed of coarse contour hairs; hind foot hairy below nearly down to the hallux; end of tail pale; chin and forethroat white; contour hairs whitish at tip ... ... *urva.*

B. No stripe on side of neck.

1. Size larger; contour hairs long, many banded, usually coarse; legs darker than body.

a. Tail about two-thirds the length of the head and body; about half the sole of the hind foot hairy in its upper part; contour hairs softer ... *fuscus.*

b. Tail longer, at most a little shorter than the head and body, sometimes longer; hind foot usually naked to the heel, at most a comparatively small area hairy in the upper part in winter.

¶ Tail tip from whitish to reddish ochreous ... *edwardsii.*

¶¶ Tail tip extensively black ... ... *smithii.*

2. Size smaller; contour hairs short, with a few bands, soft, sometimes silky; legs not appreciably darker than body ... ... *javanicus.*

Key to the Species based on skull characters.

A. Anterior chamber of bulla reduced, posterior large, subconical and prominently projecting inferiorly; first upper molar (m^1) with distinct cingulum; teeth generally more robust, less trenchant ... ... *vitticollis.*

B. Anterior chamber of bulla larger, posterior rounder, not so prominent inferiorly; no cingulum on m^1; teeth more trenchant.

1. Skull large and heavy and, as in *vitticollis*, with the sagittal and occipital crests weak so that the posterior portion of the upper surface is downcurved and the dorsal profile is never subhorizontal behind the orbits, sometimes evenly, though lightly convex ... ... *urva.*

2. Skull smaller, much less robust, actually and relatively narrower, the dorsal profile behind the orbits subhorizontal, generally slightly sinuous, the occipital and sagittal crests being well developed behind.

a. Posterior chamber of bulla larger than anterior and projecting to a lower level; skull larger.

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¶ Frontal region not noticeably elevated, the postorbital dorsal area not depressed, the upper surface of the muzzle less steeply sloped ... ... *fuscus*.

¶¶ Frontal region elevated, area behind it typically depressed, upper surface of muzzle more steeply sloped ... ... *edwardsii* and *smithii*.

b. Chambers of the bulla approximately equal and projecting to about the same level; skull smaller ... ... *javanicus*.

Herpestes edwardsii, Geoffroy.

For the bibliography and synonymy of this species see below, especially under the subspecific headings.

Distribution: N. India from Assam to the North-Western Frontier Provinces, thence westwards into Afghanistan, Baluchistan and Persia and southwards to Cape Comorin and Ceylon.

A medium-sized or tolerably large Mongoose with no stripe on the side of the neck; the tail long, at most a little shorter than the head and body, sometimes a little longer, with the hairs at its tip pallid to ochreous red, never black; the legs darker than the body; the contour hairs of the back harsh and long or longish and marked with many, generally about ten dark and light bands alternately arranged giving a speckled aspect to the pelage; the sole of the hind foot generally naked to the heel but in some cases at least the heel is covered with hair in winter.

The general colour is very variable, sometimes individually in the same locality and at the same time of year, frequently also seasonally and also racially, the variation depending on the tint of the bands in the contour hairs, the dark bands being either black or brown or even paler, when faded, both these tints being sometimes replaced by red to a varying extent; the pale bands also vary from white to buffy white; the colour is also affected by the extent of the individual bands, being lighter when the pale bands are wider than the dark and darker when they are narrower, and since the number of bands is the same whether the hairs are long or short and increase in length with their growth, specimens in the short-haired, new coat are more finely speckled than those in the long-haired, fully developed coat which is coarsely speckled; the fur or underwool which is always present but scanty or abundant according to the season or district also varies in tint from very dark olive grey, often yellowish or red, to nearly white especially when seasonally faded.

These features of the pelage apply to some other species as well as to *edwardsii*.

The skull of the adult has the forehead more or less swollen so that the summit of the muzzle is somewhat steeply sloped, the dorsal area behind the orbits is depressed and rises posteriorly towards the occiput where the sagittal and occipital crests are strongly developed, the dorsal profile being horizontal with a sinuous curvature; the posterior chamber of the bulla is roundish, larger than the anterior and projecting to a lower level.

Much confusion is connected with the name of this Mungoose. It was cited as *Herpestes mungo* by Blanford and later as *Mungos mungo* by Wroughton. But J. A. Allen (*Bull. Amer. Mus. Nat. Hist.* 47, p. 161, 1924) showed that *Mungos mungo* Gmelin is the correct title for a generically distinct African Mungoose and adopted *nyula* as the name of the common Indian species. Thomas and Wroughton, however, accepting Allen's determination of *Mungos mungo*, chose for the Indian species the name *Herpestes edwardsii* Geoffroy based upon the description and figure by G. Edwards of a living specimen of the Indian Mongoose he saw in London. Thomas's decision on this point should, I think, be accepted. He, however, assigned the name *edwardsii* to the Mongoose from Bengal, which Wroughton regarded as typical *Mungos mungo*. But Edwards's figure and description do not agree with any Bengal skins I have seen. They indicate a much darker animal, agreeing better with the South Indian Mongoose Wroughton named *ellioti*, for which Thomas substituted *carnaticus*, than with any other Indian race; and since Edwards's specimen

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is quite as likely to have been exported from Madras as from Bengal, I propose to fix *edwardsii* on that race with *ellioti* and *carnaticus* as synonyms. This leaves the name *nyula* Hodgson available for the Bengal form.

Another name, not uncommonly applied in the past to this Mongoose and recently resuscitated for it by Bechthold (*Zeitschr. Saug.*, xi, p. 149, 1936), is *griseus* Geoffroy (*Descr. de l'Egypte*, ii, p. 139, 1812) proposed for a specimen described and figured by Buffon (*Hist. Nat.*, iii, p. 174, *Suppl.*, pl. 27, 1776) as 'Le Nems' and said to have been sent to him from the interior of Africa. Buffon's description agrees with the common Indian Mongoose and, presumably for that reason, Geoffroy cited the East Indies as the locality for his *Ichneumon griseus*. There seems to be no other justification for Geoffroy's alteration of Buffon's record more than thirty years later. But *griseus* is in any case inadmissible for the species, whatever it be, because it was pre-occupied twenty years earlier by *nems* Kerr [*Anim. King*, p. 160 (1792)] based on the same Mongoose mentioned in Smellie's translation of Buffon, vii, p. 221 (1791), where the eastern parts of Africa are cited as its locality. On the available evidence *nems*, and its synonym *griseus*, cannot be applied to this Indian species.

The subspecies into which this species have been divided are by no means always easy to define or determine. Not only do they completely intergrade, but specimens from the centre of the geographical area of one race may be indistinguishable from specimens from the geographical area of another. Nevertheless I have seen no skins in Northern India like those of Travancore or Ceylon nor skins of the Ceylonese style in North India.

On the average they may be distinguished as follows:—

A. Winter coat with the contour hairs longer and more coarsely speckled, the pale speckling more in evidence, with the general hue lighter, red on head, etc. more prevalent.
   1. General colour a trifle darker with less tendency to erythrism (North and North Central India) ... *nyula*.
   2. General colour a trifle lighter, erythrism more prevalent (Valley of the Indus, N.-W. deserts, Baluchistan) ... ... *ferrugineus*.

B. Winter coat shorter, more finely speckled, pale speckling not dominant over dark, general hue darker with red everywhere less in evidence, sometimes absent.
   1. Speckling on the average coarser (S. India) ... *edwardsii*.
   2. Speckling on the average finer (Ceylon) ... ... *lanka*.

Herpestes edwardsii nyula, Hodgs.

Mangusta (*Herpestes*) *nyula*, Hodgson, *Journ., As. Soc. Beng.*, v, p. 236 (1836).

Mongos mungo mungo, Wroughton, *Journ., Bomb. Nat. Hist. Soc.*, xxiv, p. 52 (1915). (Not of Gmelin).[1]

Herpestes edwardsii edwardsii, Thomas and Wroughton, *Journ., Bomb. Nat. Hist. Soc.*, xxvii, p. 547 (1921).

Mungos mungo moerens, Wroughton, *Journ., Bomb. Nat. Hist. Soc.*, xxiv, p. 52 (1915).

Locality of the type of *nyula*, Nepal; of *moerens*, Nimar.

Distribution: Northern India from Nepal to Assam north of the Ganges and from Cutch to Bengal south of the river.

Winter coat composed of long, rather harsh contour hairs, and up to 50 mm. or more in length, and plenty of wool, the general speckling of the

[1] Wroughton's very inadequate diagnosis of this race as having the underfur comparatively very sparse and the hairs on the lower back 40 mm. long was evidently based upon a specimen or specimens from Bengal in summer coat. He could not have examined Hodgson's skins of *nyula*, regarded by him as a synonym of *mungo*. At least one of them has plentiful underwool and the rump hairs about 50 mm.

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body and tail coarse; colour very variable seasonally, the shorter new coat prevalently silvery, with contrasted black and white speckling, the black fading to brown and the white soiled in the older coat, but even in the new coat the speckling may be brown and buffy or yellowish; hairs of the underside with dark speckling or fading to uniformly pale; typically some red on the muzzle, cheeks and ears; sometimes a little on the crown and nape; the wool varying from dark olivaceous grey to soiled white; the legs dark or rufous brown and grizzled.

The following notes show the individual variations in different districts.

Nepal. Hodgson recorded *nyula* as the common Mongoose of the Nepalese lowlands and North Behar, but his description of the type does not fit any of the six undated skins he sent home. The colour was 'mixed rich, red brown and hoary yellow', the long harsh hairs having from 10 to 12 rings of alternate brown and yellow, the ears, face, and limbs being redder and the underside pale yellow. This was apparently an aberrant reddish specimen indistinguishable from some specimens of the following race, *ferrugineus*. One of his skins in the British Museum (No. 43.1.12.17) may be the type, but the dark speckling is only brown, pale drabby, with the head and nape rather brighter. His series varies as follows:—The contour hairs on the rump range from about 40 to 50 mm. and the wool is copious or very scanty. The dark speckling varies from blackish and blackish brown to darker or paler brown, the pale from silvery to dull grey or drab and the wool from yellowish olive to pale drab or soiled whitish. The lower side is drabby or greyish, sometimes indistinctly dark speckled; the head has some red at least on the muzzle, cheeks and ears, sometimes on the crown and nape as well; the tail is like the body, with the tip, when present, soiled whitish; the legs are dark brown or rufous brown and grizzled, one skin showing abundance of rusty red above the hocks.

The colour of these skins of Hodgson's has probably deteriorated with age; but the following from places to the east of Nepal and north of the Ganges are not racially separable from them.

Darbhanga, 150 ft. Several skins from Bahgownie (*Crump*), July 25 to October 10, show interesting individual variations. The coat is from about 30 to 40 mm. according to the earlier or later date, the wool being similarly negligible in amount or fairly plentiful; the speckling is contrasted black and white in the new short coat, duller and less contrasted in the older longer coat; the wool varies from olivaceous to yellowish and frequently shows through the contour hairs, affecting the coloration of the dorsal surface.

Haldibari, S. of Sikhim, 150 to 200 ft., April 13 to 20. One specimen is a trifle more silvery than the palest Nepal skin. Another is intermediate between the palest and the brownest Nepal skins. The wool in both is pale grey.

Jalpaiguri, N. of Kuch Behar, April 18. A skin resembling the second from Haldibari in having pale brown speckling.

Goalpara in Assam, S. of the Brahmaputra, August. A ♀ with the coat 34 mm., the colour finely speckled with black, brown and white and the wool olive grey exactly matches one of the Darbhanga skins dated August 25.

In two districts to the west of Nepal and north of the Ganges, namely from Kumaon, 1,100 to 2,500 ft., November and December, and from Pilibhit in Rohilkund, 800 ft., March, several specimens were collected and are very much alike, the general colour being speckled black and white, as in the first described specimen from Haldibari; the wool is pale buffish white in the Kumaon skins but whiter in those from Rohilkund. These skins were identified by Wroughton as *pallens* (see below p. 217) and quite correctly according to his erroneous conception of his *mungo*, i.e. *nyula*.

From two localities south of the Ganges in Western Bengal, namely Hazaribagh, 600 to 1,800 ft., April 18 to June 26 and from Daltonganj, 600 ft., March 21 to April 1, Crump sent several skins which call for no special comment, except that one from Daltonganj has a good deal of red on the head and some on the nape as in the brownest of the Nepal skins.

Gwalior. A good series of skins from several localities and dated from June to the end of November exhibits great variation in colour although not the ferruginous phase, there being at most a little red on the muzzle. In the late autumn coat (October and November) the contour hairs, about 55 mm., are speckled black or blackish and clear white, those of the underside being

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ticked with black; the feet are dark with hardly any brown tinge and the tail-tip is ochreous or flavous. In the summer coat, June and July, the contour hairs of the dorsal side are faded, speckled very pale brown and soiled white, there is no dark speckling below and the legs are much paler and browner; the underwool bleaches from dark olive grey to dirty whitish.

Most of the skins Wroughton assigned to *moerens* are in fresh unfaded coat, with the black and white speckling sharply contrasted, and resemble the darkest of the skins from Darbhanga (August) and Gwalior (October).

Cutch, 200 to 500 ft., July 10 to August 15. Nine skins in new short coat are mostly speckled black and white, one being browner in hue, the wool is scanty and varies from smoke grey to greyish ochreous, the legs from dark to reddish brown speckled with grey; the head has a little red.

Kathiawar, 200 to 2,500 ft., October 6 to December 1. Eleven skins have the coat fuller and longer in accordance with the later season, but are generally similar to the Cutch series, varying to a certain extent in the clearness of the white speckling, in the wool which is darker or lighter olivaceous grey and in the amount of red on the head and limbs.

Nimar. Two skins, including the type of *moerens* from Ganoor, 1,000 ft., December 22 and 23, resemble the Kathiawar lot but have the wool ashy grey, the type itself having some red on the nape. One from Asigarh, 1,500 ft., November 3, has the wool much darker, olivaceous.

Berar, Ellichpar, 1,500 ft., May 17, a ♂ closely resembles the type from Nimar but has more reddish brown on the muzzle and legs and the wool slightly yellowish grey. Considering the date, it is surprising that this skin shows no sign of coat change.

E. Khandesh, one from Shendurni, 900 ft., March 30, is speckled black and white like the preceding and has the wool olivaceous grey, and another from Parola, 8,800 ft., March 13, has begun to bleach, the dark speckling being brown and the wool pale grey.

Hoshangabad, Sohagpur, 1,000 ft. Five skins, April 10 to 13, vary greatly in colour. One is speckled black and white, like the preceding lots, with the legs very dark brown. A second is much paler with broader white bands, some red on the back and the wool whitish. A third has the dark speckling faded mostly to pale brown and not strongly contrasted, the hind feet rufous, the wool drabby and the belly hairs not speckled as they are in the first. The contour hairs on the rump vary from about 30 to nearly 50 mm. This series showing seasonal change in colour connects typical *moerens* with the Nepalese series.

Flesh Measurements and Weights of some Specimens of *nyula*.

	Head and Body	Tail	Hind-foot	Weight lbs.
Cooch Behar, Haldibari, ad. ♂	15⅜	14⅖	3	2¾
Darbangha ... ad. ♂	15⅜	14½	3–	...
Daltonganj ... ad. ♂	16⅜	15½	3½	...
Kumaon, Ramnagar ... ad. ♂	17	16	3⅕	3½
,, ,, ... ad. ♂	16⅜	14½	3⅕	4
Rohilkund, Pilibhit ... ad. ♂	16	14⅛	3	3
Gwalior, Guna ... ad. ♂	17⅖	15⅘	3½	...
,, Ghatigaon ... ad. ♂	17	14⅘	3+	3¾
Hoshangabad ... ad. ♂	17½	15⅜	3+	3½
Kathiawar ... ad. ♂	16⅘	14⅛	3–	3¼
Cutch, Nokania ... ad. ♂	15⅘	15⅛	3+	3
Daltonganj ... ad. ♀	14⅜	14⅜	3–	...
Kumaon, Naini Tal ... ad. ♀	15⅘	13⅘	2⅘	2
,, Ramnagar ... ad. ♀	15⅗	15⅖	2⅘	...
Rohilkund, Pilibhit ... ad. ♀	15⅛	13½	2⅘	2
Gwalior, Ghatigaon ... ad. ♀	15⅘	14	2⅘	2¼
Nima (*mœrens* type) ... ad. ♀	15⅗	14⅖	3–	2¾
Kathiawar ... ad. ♀	15⅘	15⅛	3	2½
Cutch, Nokania ... ad. ♀	14⅗	13	2⅗	...

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SKULL MEASUREMENTS OF *H. edwardsii nyula*.

LOCALITY AND SEX	Cond. Bas. Length	Zygom. Width	Post. Orb. Width	Int. Orb. Width	Max. Width	Mand. Length	pm^4	m_1
Nepal (Hodgson) ... ad. ♂	78	42	13	15	15	...	8 ×6	...
Darbangha ... ad. ♂	77	38	11	14	14	...	7 ×5	...
Hazaribagh ... ad. ♂	84	42	11	16	15	56	7½×5	7
Kumaon ... ad. ♂	82	42	14	16	15	53	7½×5½	7
Bahraich, U.P. ... ad. ♂	77	38	14	15	14	50	7 ×5	7
Daltonganj ... ad. ♂	82	40	13	16	15	52	8 ×5	7
Gwalior ... ad. ♂	82	44	13	16	16	...	7½×5	...
,, ... ad. ♂	79	41	12	14	14	52	7 ×4½	6
Berars ... ad. ♂	81	45	13	15	15½	...	7½×6	...
Kathiawar ... ad. ♂	83	...	14	16	16	53	8 ×6	7
Cutch ... ad. ♂	80	41	12	15	15	51	8 ×6	7
,, ... ad. ♂	77	42	13	16	15	50	7½×5½	7
Nepal (Hodgson) ... ad. ♀	71	36	12	12	12	46	7 ×5½	7
Daltonganj ... ad. ♀	75	38	11	14	13	49	7 ×5	7
Gwalior ... ad. ♀	79	41	12	15	13	52	8 ×5	7
,, ... ad. ♀	75	38	11	14	13	49	7 ×5	7
Nimar (*moerens* type) ... ad. ♀	80	38	12	15	14	51	7 ×5	7–
Cutch ... ad. ♀	73	36½	12	13½	13	46	8 ×6	7

The specimens in this table from Nimar, Berars, Kathiawar and Cutch were referred by Wroughton to *moerens*.

Male skulls are on the average larger than female skulls, although they overlap in size.

Herpestes edwardsii ferrugineus, Blanf.

Herpestes ferrugineus, Blanford, *Proc. Zool. Soc.* (1874), p. 661, pl. 81.
Herpestes andersoni, Murray, *Vent. Zool. of Sind,* p. 34 (1884).
Mungos pallens, Ryley, *Journ., Bomb. Nat. Hist. Soc.,* xxii, p. 660 (1914).
Mungos ferrugineus and *pallens,* Wroughton, *Journ., Bomb. Nat. Hist. Soc.,* xxiv, pp. 51-4 (1915).
Herpestes griseus montanus, Bechthold, *Zeitschr. Säug.,* xi, p. 149 (1936).

Locality of the type of *ferrugineus,* Larkhana, Sind; of *andersoni,* Kotree, Sind; of *pallens,* Palanpur, N. Gujerat; of *montanus,* Hazara.

Distribution: Mainly the desert districts of N.-W. India in the valley of the Indus and Sutlej and to the east in Rajputana and to the west into Baluchistan and Persia.

Distinguished on the average from *nyula* by its paler, whiter colour, with less black speckling in the contour hairs, its paler wool and by a greater tendency for the replacement of the dark speckling by red or rich ochreous, the replacement being sometimes complete as in the type of *ferrugineus*, sometimes partial as in *andersoni*, whereas in the normal form of the race represented by the type of *pallens* there is no red on the body, although the red of the head and limbs is typically more pronounced and contrasted than in *nyula*.

The type of *H. ferrugineus,* Blanford, from Larkhana, Sind, was red all over, all the normal black speckling of the coat being replaced by rusty red, the tail becoming progressively redder towards the tip. Blanford at first regarded this as representing a valid species, but subsequent examination of intermediates induced him finally to regard it as a 'variety' of the common Indian Mongoose.

Murray recorded apparently similarly red specimens as *ferrugineus* from Kotree and Karachi in Sind, and at the same time described as *H. andersoni*

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a partially red specimen from Kotree. This had the contour hairs of the back banded black and white, with a ferruginous apical or subapical tip, the tail hairs mostly white with extensively reddened tips; the forehead ferruginous and rather darker red than the chin, throat and the rest of the under side; the feet rufous brown with black toes; the wool ferruginous at the summit, yellowish-white at the back.

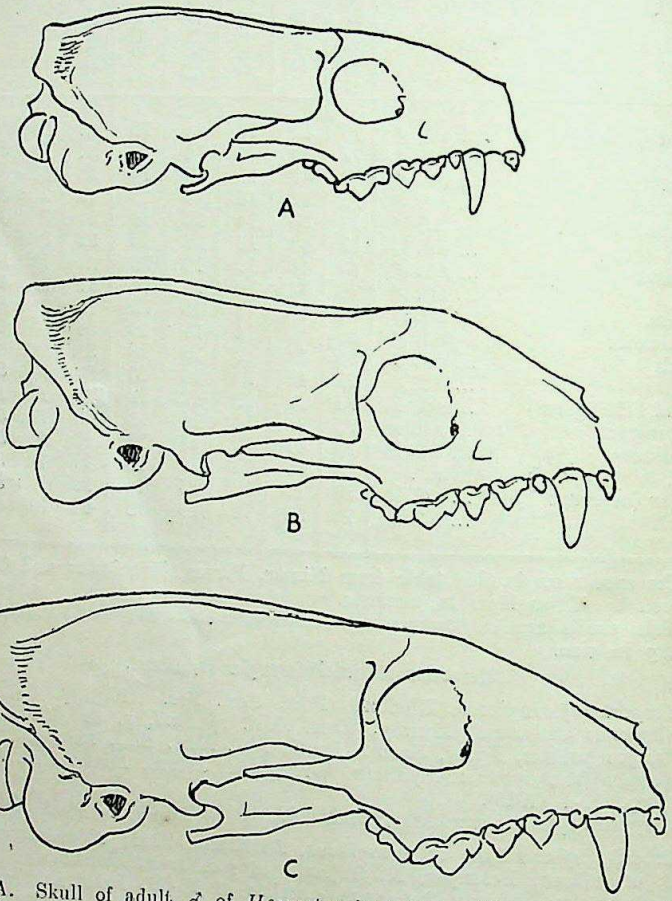

Fig. 1.—A. Skull of adult ♂ of *Herpestes javanicus pallipes* from Kandahar.
B. Skull of adult ♂ of *Herpestes edwardsii nyula* from Nepal.
C. Skull of adult ♂ of *Herpestes fuscus fuscus* from S. Coorg.

There are no specimens in the British Museum like the type of *ferrugineus* and Wroughton's diagnosis of *ferrugineus*, which he regarded as a race, was based on specimens evidently closely resembling *andersoni*, although not red below or in the wool. The occurrence of typical *ferrugineus* and of *andersoni* at Kotree suggests that they merely represent colour phases of one and the same form. Also the occurrence of specimens evidently closely resembling *andersoni* in the same locality as specimens indistinguishable from *pallens* justifies in my opinion the view that *ferrugineus* and *andersoni* are red or reddish mutants of *pallens*, the normal form. Unfortunately the name *ferrugineus*, given to a hitherto unique specimen exhibiting the extreme phase of erythrism, has to be adopted for this race, as the earliest proposed.

The following account of skins from different districts shows the range of variation in colour and other characters:—

Sind. In four skins from Khairpur (Prater), April 8 to 15, the dark speckling of the coat varies from black to very pale brown, the wool from

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[Specimen Illustration]Digitized by Arya Samaj Foundation Chennai and eGangotri

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List of Coloured Plates.

AMHERSTIA NOBILIS (the Noble Amherstia).
BAUHINIA VARIEGATA (the Variegated Bauhinia).
BOMBAX MALABARICUM (the Silk Cotton Tree).
BUTEA FRONDOSA (the Flame of the Forest).
CASSIA FISTULA (the Indian Laburnum).
CASSIA JAVANICA (the Java Cassia).
CASSIA RENIGERA (the Burmese Pink Cassia).
COCHLOSPERMUM GOSSYPIUM (the Yellow Silk-Cotton Tree).
COLVILLEA RACEMOSA (Colville's Glory).
CORDIA SEBESTENA (the Scarlet Cordia or Aloe-wood).
CRATAEVA NURVALA (the Sacred Barna).
DILLENIA INDICA (the Large-flowered Dillenia).
ERYTHRINA INDICA (the Indian Coral Tree).
GARDENIA LUCIDA (the Brilliant Gardenia).
GLIRICIDIA MACULATA (the Spotted Gliricidia).
GUAIACUM OFFICINALE (the Lignum Vitae Tree).
JACARANDA MIMOSAEFOLIA (the Mimosa-leafed Jacaranda).
KLEINHOVIA HOSPITA (the Kleinhovia Tree).
KYDIA CALYCINA (Roxburgh's Kydia).
LAGERSTROEMIA FLOS REGINAE (the Queen's Flower).
MILLINGTONIA HORTENSIS (the Indian Cork Tree).
PELTOPHORUM FERRUGINEUM (the Rusty Shield-Bearer).
PLUMERIA ACUTIFOLIA (the Pagoda Tree) and PLUMERIA RUBRA (the Frangipani).
POINCIANA REGIA (the Gul Mohur or Flamboyant Tree).
PTEROCARPUS INDICUS (the Padauk).
SARACA INDICA (the Asoka Tree).
SOLANUM MACRANTHUM (the Large-flowered Nightshade or Potato Tree).
SPATHODEA CAPANULATA (the Scarlet-Bell or Fountain Tree).
STERCULIA COLORATA (the Coloured Sterculia).
TECOMELLA UNDULATA (the Wavy-leafed Tecomella).
THESPESIA POPULNEA (the Bhendi Tree).

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drab to palish grey, the tail tip from reddish ochreous to flavous, the head being dull brownish with only a little red on the muzzle. Two from Sukkur, March 16 and 27, on the contrary, have the head, nape and tail-tip reddish ochreous and a faint reddish cast over the back. These two evidently come near the type of *andersoni* in tint. Nearer still and possibly one of Murray's specimens of the latter is a skin from the Karachi Museum, labelled Sind and dated December, which has the dorsal surface speckled black and white with a reddish cast, the head, neck and tail-tip reddish ochreous, and the wool yellowish-drabby. As mentioned below one of the skins from Kangra closely matches the Sukkur skins except that the tail-tip is flavous.

An aberrant ♀ skin from Tata, west of the Indus in S. Sind (McCann), October 23, with the speckling contrasted black and white, a little red on the head but none elsewhere, the feet dark brown, grizzled, and the wool olivaceous grey, exactly matches skins from Cutch, July and August, identified by Wroughton as *moerens*.

Gujerat, Palanpur, 150 ft. (Crump). An adult ♂ (type of *pallens*). March 21, has the coat thinnish but 52 mm. long on the rump, the general colour of the back coarsely speckled white and brown, but with some black on the back, the head reddish, the tail-tip flavous, the wool greyish white, the legs reddish brown and the underside white. An adult ♀ from Danta, 100 ft., January 25, has the coat 45 mm. the general tint with blacker speckling, as if less faded in accordance with the different date; but the fore paws, the hind feet below the hock, the inside of the thighs, and the abdomen are albino.

Rajputana. Seven skins from several localities, dated January to June, differ greatly in coat and colour according to season. A ♀ from Jodhpur, February 22, the darkest of the series, has the coat 50 mm., the general colour brownish, fitting in with the Nepalese series of *nyula*, the wool plentiful, pale drab in hue with a yellowish suffusion in places, the drab matching the wool of a Nepal skin with the palest wool. Of three skins from Sambhar two are sharply contrasted, one, January 25, being speckled silver and black, a second, April 27, pale brown and soiled white, a third, March 5, intermediate between them, the wool being soiled white in all. Six from Mt. Abu, 4,300 ft., May 19 to June 5, have the coat short and harsh, the white speckling dominant, the dark from blackish to drabby brown with little, if any, light coloured wool but the head, especially the nose, and the legs, especially the hind, reddish and contrasted with the pale body; the tail-tip pallid.

Kohat, south of Peshwar, N.-W. F., 2,000-2,700 ft. A ♀, October 25, is the reddest and the most like *andersoni* of all the skins in the British Museum. The coat, 53 mm., has plenty of wool greyish and drabby at the base with a buff tinge at the summit; the head and cheeks are rusty and slightly grizzled, the neck is a little less red, but that tint is traceable in all the dorsal contour hairs where it more or less displaces their black tips; the tail is rather heavily red especially at the tip and the legs are grizzled rufous brown. A second ♀, March 9, has the coat 59 mm., the wool the same, but the head, body and tail are much paler and less red, with the white of the contour hairs more manifest; the feet, however, are the same. These two skins suggest that the difference between them is due to the gradual bleaching of the winter coat between the end of October and the beginning of March. In all probability the March skin would have lost all its red before the coat was shed. The skin from Sind (Karachi Museum), December, is nearly intermediate between the two.

Chaklala, Rawalpindi, in the Upper Punjab (Stockley). Two skins, July 6 and 13, closely resemble the skins from Mt. Abu in Rajputana, both in the condition of the coat and in colour, but one skin has some red on the nape; the scanty wool is soiled yellowish in both skins.

Hazara between Peshawar, N.-W. F., and Kashmir (not Hazara in Afghanistan). An ad. ♂ skin, undated but in full winter coat with the contour hairs about 55 mm. and abundance of underwool; the general colour is pale, the contour hairs in accordance with their length being broadly banded whitish and blackish brown with the tips from the nape to the rump and on parts of the tail slightly reddened, but the red cast hardly visible unless the coat is raised; the wool is yellowish or yellowish grey, becoming whitish on the rump; the tail tip is whitish, the legs rusty brown and grizzled, the head reddish and the under side uniformly drabby yellow. This skin, the

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type of *Herpestes griseus montanus*, obviously represents the winter phase of the two summer skins from Rawalpindi. It is very like the March skin from Kohat but not so red anywhere, and is very similar to the type of *pallens* except that the bands on the tail are blacker and there is a slight reddish cast on the body.

Chamba, 3,000-3,300 ft. (Wells), January 22 to 25. Four skins collected at Changa vary considerably in colour. The coat is full, ranging from about 45 to over 50 mm. in length. A ♂ has the speckling normally coarse, black and whitish, with no red on the dark brown head except on the cheeks and ears, the wool pale greyish and the legs dark brown, speckled, with no appreciable red tinge, and the tail tip flavous. A ♀ is darker, with the pale speckling finer and buffy or yellowish in tint, the head brownish red but no red on the body, the wool dark olivaceous grey, the legs very dark with the toes nearly black and the tail-tip dark ochreous. Another ♀ has the head and nape, especially the head, rusty brown, there is a reddish wash on the back, above the hock and on the base of the tail, the tip of the latter being flavous; the fur is mostly drabby grey, the fore legs reddish brown, with hardly any pale speckling, from above the wrist, with some white hairs on the toes, the hind the same but more speckled and without trace of albinism. This specimen almost exactly matches the skin from Kohat, March 9, except that the tail-tip is flavous.

Kangra, 2,000-7,000 ft. (Wells). About 20 skins, mostly labelled Kangra, 2,000 ft., March 20 to April 2, with a few more from Dhamtal, 2,000 ft., November 11; Guggal, 4,000 ft., February 10; Gopalpur, 7,000 ft., March 9; and Sanyala, 5,000 ft., April 18. The coat is full, from about 45 to 55 mm., the general colour is on the whole tolerably uniform and grey, coarsely speckled with white and black or brownish black; the head is normally reddish and frequently there is a reddish cast on the nape, back and the root of the tail, the tip of the tail being always flavous; the wool is pale grey or drabby grey, often noticeably darker on the fore back than on the hind back and rump and the legs are brown, nearly always with a rusty tinge. Two skins differ somewhat from the average. The first is a single adult ♀ from Dhamtal, November 11, which has the wool uniformly ochreous buff all over the upper side, suggesting that the pale wool in the March skins may be faded. In the colour of its wool this Dhamtal skin seems to approach the type of *andersoni* from Kotree, Sind. The second is an adult ♂ from Sanyala, April 18, which has the dorsal coloration generally much lighter than in the others, with the head and nape, especially the head bright ochreous red and the legs ochreous and unspeckled, the toes of the fore foot being albino. This skin closely resembles examples from Sukkur in Sind and elsewhere, which fall into the *andersoni*-phase of *ferrugineus*, except that the tail-tip is flavous not ochreous. The skins with the reddish wash also approach that phase, but they differ very little from the redder of the two examples of *nyula* from Daltonganj, whereas those which have only the normal amount of red on the head and none elsewhere are practically indistinguishable from some examples assigned to *nyula*. I refer the series to *ferrugineus* because of the considerable percentage of specimens exhibiting a tendency to redness. They may, however, be considered intermediate between *nyula* and the red phase of *ferrugineus* as the skins from Kumaon and Rohilkund are intermediate between *nyula* and the pale or *pallens* phase of *ferrugineus*.

Baluchistan. Seven skins (J. E. B. Hotson) collected at various localities and dates exhibit variations similar to those of the other districts considered. One from Mand, 900 ft., December, one from Gumajgi, 500 ft., 50 miles west of Turbat, December, one from Panjgur, 3,200 ft., January, closely match the skins from Kumaon and Rohilkund. Another from Geh, on the Perso-Baluchi border, January, is also like them except that the wool is ashy grey at the base, buffy at the summit. Seasonal change is illustrated by a second skin from Panjgur, May 26, which has the coat thin and harsh, the general colour dull, the black speckling faded to pale brown, the white speckling soiled, the scanty wool drabby grey showing under the hair; and one from Jebri, 147 miles south south-west of Kelat, 3,775 ft., August 31, also in poor coat, has the speckling blurred and faded and with the brownish grey wool giving a general tawny hue to the pelage. None of the above described skins shows any reddish tinge except a trifle on the head; but one from Qasrgand on the Perso-Baluchi border, 1,710 ft., December 29, is of the ferruginous

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andersoni type closely matching the October skin from Kohat but not quite so red on the back although redder than the Sind specimen from the Karachi Museum.

The dimensions in the following table suggest that specimens from Kangra and Chamba are larger, sex for sex, in length of head and body than those from Sind, Rajputana etc. and also than those assigned to *nyula*. But they were measured by a different 'hand'; and since the tails and hind feet, in which there is less likelihood of discrepant results, are not longer, it seems wiser to suspend judgment on the point and to refrain from indicating by a new racial name the apparent difference, especially as it is unsatisfactorily supported by the size of the skulls which at most are a mere trifle longer in condylobasal length. Additional observations on the subject are given below under the notes on the skulls.

To the measurements of the British Indian specimens in this table are added those of an adult ♂ from Shiraz, Persia, collected by Sir J. E. B. Hotson, attesting general agreement with specimens from Baluchistan, Sind and Gujerat. It belongs to the *pallens* phase, showing no special erythrism.

Only a few weights were recorded. The two ♂ specimens from Mt. Abu, Rajputana, were respectively 3 and $2\frac{3}{4}$ lbs., the ♂ from Palanpur, Gujerat, the type of *pallens*, was $3\frac{1}{4}$ and the ♀ from Danta, Gujerat 2 lbs.

FLESH MEASUREMENTS IN ENGLISH INCHES OF SOME SKINS ASSIGNED TO *ferrugineus*.

			Head and Body	Tail	Hind foot
Kangra (largest)	...	ad. ♂	$21\frac{1}{5}$	14	$3\frac{1}{5}$
,, (smallest)	...	ad. ♂	$18\frac{4}{5}$	14	3—
,, Average of 9	...	ad. ♂	$19\frac{3}{8}$	...	...
Chamba	...	ad. ♂	$20\frac{4}{5}$	$15\frac{6}{8}$	$2\frac{4}{5}$
Rajputana, Mt. Abu	...	ad. ♂	$17\frac{1}{5}$	$15\frac{1}{5}$	$3\frac{1}{2}$
,, ,, ,,	...	ad. ♂	16	$13\frac{1}{4}$	$3\frac{1}{2}$
Gujerat (*pallens* type)	...	ad. ♂	$15\frac{1}{5}$	16—	3—
Sind, Sukkur	...	ad. ♂	$16\frac{6}{8}$	$15\frac{4}{5}$	$3\frac{1}{2}$
,, Khairpur	...	ad. ♂	$15\frac{3}{5}$	$13\frac{3}{5}$	3—
Baluchistan, Mand	...	ad. ♂	$15\frac{1}{5}$	$14\frac{3}{8}$	3+
Persia, Shiraz	...	ad. ♂	$15\frac{1}{5}$	$15\frac{6}{8}$	3
Kangra (largest)	...	ad. ♀	$18\frac{6}{8}$	$15\frac{1}{5}$	3—
,, (smallest)	...	ad. ♀	$14\frac{1}{5}$	$14\frac{2}{8}$	$2\frac{4}{5}$—
,, Average of 10	...	ad. ♀	$16\frac{4}{5}$	...	...
Chamba	...	ad. ♀	$16\frac{4}{5}$	14	$2\frac{4}{5}$
,,	...	ad. ♀	$15\frac{6}{8}$	15	$2\frac{3}{8}$—
Kohat, N.W.F.P.	...	ad. ♀	14	$14\frac{3}{4}$	$2\frac{4}{5}$
Sind, Sukkur	...	ad. ♀	$14\frac{4}{5}$	$15\frac{1}{4}$	3—
,, Khairpur	...	ad. ♀	$14\frac{3}{8}$	$14\frac{1}{5}$	$2\frac{4}{5}$
,, Tata	...	ad. ♀	$14\frac{4}{5}$	$12\frac{1}{5}$	3—
Gujerat, Danta	...	ad. ♀	15	$14\frac{1}{5}$	$2\frac{4}{5}$
Baluchistan, Qasrqand		ad. ♀	14	$14\frac{3}{4}$	$2\frac{4}{5}$

Comparing skull-measurements with flesh-measurements there are one or two points to be noted. The two measured ♂ skulls from Kangra, 83 and 77 mm. respectively in condylo-basal length, agree very closely with the two ♂ skulls from Mt. Abu, in S. Rajputana. But the head and body of the skin of the larger Kangra skull is indicated as over 3 in. longer than the skin of the larger Mt. Abu skull and the smaller Kangra skull, which is 2 mm. shorter than the smaller Mt. Abu skull, belongs to a skin of which the recorded head and body length is very nearly 3 in. longer than in the Mt. Abu specimen. These recorded differences cast further doubts on the trustworthiness of the head and body lengths of the Kangra specimens. Also there is by no means always correspondence in size between skulls and head

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and body measurements. The skulls of the two Kangra specimens measuring 21⅕ and 18⅘ in. respectively are alike 77 mm. in condylobasal length whereas two specimens measuring respectively 20⅝ and 20 in. have skulls 83 mm. long.

The largest of the Kangra skulls marked ♀, with a length of 81 mm. has all the characters of a ♂. It has the same number as the ♀ skin measuring 18⅜ in. in head and body. But one of the ♂ skins has a ♀ skull assigned to it. Possibly they got mixed. At all events the rest of the ♀ Kangra skulls range from 76 to 72 mm. in length, the average of 8 being 74¾ mm.

Skull Measurements of *ferrugineus*.

Locality and Sex	Cond. bas. Length	Zygom. Width	Post Orb. Width	Int. Orb. Width	Max. Width	Mand. Length	pm^4	m_1
Kangra (largest) ... ad. ♂	83	44–	13	16½	15	55	8×5½	7
,, (smallest) ... ad. ♂	77	39	11	14	14	49	7×5	6½
,, Average of 6 ... ad. ♂	81	...	...	...	..	...	...	...
Chamba ... ad. ♂	(81±)	42	12	16	15	54	7½×5½	7
Hazara (type of *montanus*) ... ad. ♂	(80±)	40	13	13½	14½	52	8×6	7
Rajputana, Mt. Abu. ... ad. ♂	82	43½	12	17	14	53	...	...
,, ,, ,, ... ad. ♂	79	41	13	15	13	51	7½ 5	7–
,, Sambhar ... ad. ♂	78	40	13–	14	14	51	8×5½	7½
,, ,, ... ad. ♂	74	39	12	15	14	48	7½×5	6½
Sind, Khairpur ... ad. ♂	79	40	12	15½	14½	51	8×6	7½
,, Sukkur ... ad. ♂	78	41	12½	15	14½	52	7½×5	7
Gujerat, Palanpur (*pallens* type) ... ad. ♂	79	41	12	15	15–	51	8+×5+	7
Baluchistan, Panjgur ... ad. ♂	75	40	15	15	15	50	8–×5	7
Persia, Shiraz ... ad. ♂	78	39½	13	15	14	51	8×5	7
Kangra (largest) ... ad. ♀	81	44	13½	16+	16+	54	8×5½	7
,, (smallest) ... ad. ♀	72	36	12–	14–	13–	48	7×5	7
,, Average of 9 ... ad. ♀	75½	...	...	...	...	...	...	...
Chamba ... ad. ♀	77	37	13	13½	13	51–	8×5	7
,, .. ad. ♀	73	38	13	13	13½	47	7½×5	6½
Kohat, N.W.F. Prov. ... ad. ♀	75	37	15	14½	13	48–	8×6	7
Rajputana, Jodhpur ... ad. ♀	73	38	12–	14–	13	...	7×5	...
,, Sambhar ... ad. ♀	71	35	11	12	12	45–	7×5	6½
Sind, (Karachi Mus.) ... ad. ♀	75	39	12	14	13	...	7½×5	...
,, Khairpur ... ad. ♀	74	37½	10	14	13	49	7×5	7–
,, ,, ... ad. ♀	72	36	11	13	13	46+	7+×5	6½

Herpestes edwardsii edwardsii, Geoffroy.

'The Indian Mongoose', Edwards, *Nat. Hist. Birds*, iv, p. 199 (1751).

Herpestes edwardsii, Geoffroy, *Descr. de l'Egypte*, ii, p. 139 (1812), (not of Thomas and Wroughton).

Herpestes pondiceriana, Gervais, *Voy. de la Bonite*, i, p. 32 (1841).

Mungos mungo ellioti, Wroughton, *Journ., Bomb. Nat. Hist. Soc.*, xxiv, pp. 51 and 53 (1914), (not *ellioti*, Blyth).

Herpestes edwardsii carnaticus, Thomas, *Journ., Bomb. Nat. Hist. Soc.*, xxviii, p. 23 (1921).

Locality of the type of *edwardsii*, 'East Indies'; of *pondiceriana*,[1] Pondicherry; of *ellioti* Wrought. and *carnaticus*, Dharwar.

[1] This name was apparently intended for a specimen from Pondicherry mentioned by Cuvier and Geoffroy (*Hist. Nat. Mamm.* 1819) as La Mangouste.

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Distribution: Southern India, Western and Eastern Ghats, south of the Narbada River, from Ratnagiri to Travancore and Madura.

Distinguished on the average in its unfaded coat from *nyula* by its darker general tint owing to the blackish brown bands in the hairs being more extensive than the whitish or buffy white bands. The coat also is shorter, about 40 mm. or a little over; the wool is dark, usually olive grey but often with a strong ochreous tinge; there is typically some red on the head and ears, but this is variable in amount; the legs are darker or lighter brown and grizzled, the tail tip is pale ochreous and the under side is usually, but not always, speckled with black or brown.

This description applies generally to a large number of skins from the following western localities:—Ratnagiri, January 21 to 28; Dharwar, 2,000-2,500 ft., October 30 to February 18; N. Kanara, 1,900 ft., January; N. Coorg, 3,555 ft., January 16 to February 15; S. Coorg, 2,000 ft., January 10 to February 6; Seringapatam, 2,340 ft., October 12 to 28; Cochin, 1,500 ft., June 8; Nilgiri Hills, 3,500 ft., undated; Trivandrum in Travancore, August 4 to September 2. Of these the Travancore skins are practically indistinguishable from those of the Ceylon race, *lanka*.

Skins from the eastern districts of S. India are more variable. Of two, undated, ticketed Madras (Jerdon), one is like those above described, the other has the pale speckling more silvery. Similarly paler is one from the Palkonda Hills, S. Cuddapah, 1,000 ft., August 17; one from the Shevaroy Hills, 4,500 ft., May 17; some from Tirthamalai, Salem, 3,000 ft., June 22 to July 9; and one undated, from Kombu, S. Coimbatore; but one from the northern slopes of the Palni Hills, 3,000 ft., December 15, is a dull dark, short coated skin, and of two from High Wavy Mountain in Madura, near the Travancore border, May 28 to 30, one is like the Salem skins, the other is paler with a yellowish wash, broader pale bands in the contour hairs, and altogether is more like *nyula* than typical *edwardsii*.

The Survey also secured through Baptista many additional specimens, from Kurnool, May, the Palkonda Hills, 1,500 ft., July; the Vontimitta Range, 325 ft., August; the Dharmapuri Range, N. Salem, 850 ft., August and October; and the Denkanikota Range, 3,062 ft., October. These skins are all pale and silvery very like pale skins of *nyula* but with slightly finer speckling and almost always less red on the head and legs, although one from the Palkonda Hills is as red on the head as typical *nyula*.

Judging from a specimen in the British Museum collected by Dr. Cantor in Wellesley Province and identified by him as *Herpestes griseus*, it is this Southern Indian race that occurs in the Malay Peninsula and not the 'Bengal' race (*nyula*) as supposed by Blyth and Jerdon. The first record from Malacca was made by Cuvier and Geoffroy [*Hist. Nat. Mamm.* pl. 189 (1819)] who figured and described a specimen as 'La Mangouste' and later (*Suppl. Table Gén.*, p. 3 (1842)] identified it as *Herpestes mungo*. This specimen was described as *Herpestes frederici* by Desmarest [*Dict. Sci. Nat.*, xxix, p. 60 (1823)]. Subsequently it was named *H. malaccensis* by Fischer [*Syn. Mamm.*, p. 164 (1829)], who erroneously, and to the confusion of some authors, assigned *malaccensis* to Cuvier. But clearly *malaccensis* is a synonym of *frederici* and both are synonyms of *edwardsii* according to my identification of the last. The point is of some importance in nomenclature because, as stated above, Blyth and, following him, Jerdon used *malaccensis* for an Indian Mongoose; and comparatively recently Kloss when citing a specimen from Larut, nr. Perak, as *Mungos mungos* added that if distinct the Malayan animal would take the name *malaccensis* [*Journ., Fed. Mal. St. Mus.*, vii, p. 123 (1917)]. Kloss's ♀ specimen measured 15 in. in the head and body, but had an exceptionally short tail, only 11½ in., almost exactly the same as in one of Pillay's specimens of *edwardsii* from Travancore and in some specimens of *lanka* from Ceylon; but Cuvier's specimen, the type of *frederici* (*malaccensis*) was 11 in. in head and body, 12 in. in the tail. No doubt it was young and probably the terminal hairs were included in the tail which would make it, without the hairs, about as long as the head and body.

This Mongoose is believed to have been imported into Malaya from India. This seems probable since there is no record of *edwardsii* from Burma.

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Flesh measurements of *H. edwardsii edwardsii* are as follows:—

		Head and body	Tail	Hind-foot
Dharwar (*carnaticus* type)	ad. ♂	19⅕	16⅖	3⅗
,, ,,	ad. ♂	17⅕	16	3
S. Coorg	ad. ♂	17	14	3–
Cochin	ad. ♂	18⅕	15¾	2¾
Trivandrum	ad. ♂	15⅗	13⅕	2⅘
Kurnool	ad. ♂	17⅗	16⅕	3¼
,,	ad. ♂	16⅓	16⅗	3⅓
Palkonda Hills	ad. ♂	17⅕	14⅘	3⅕
,, ,,	ad. ♂	15⅕	14	3⅕
Vontimitta Range	ad. ♂	17⅕	15⅕	3¼
Shevaroy Hills, Salem	ad. ♂	18⅘	17⅗	3⅕
Madura	ad. ♀	18⅕	16	3–
Ratnagiri	ad. ♀	15⅖	13⅕	2⅗
Dharwar	ad. ♀	15⅗	15⅗	2⅘
N. Coorg	ad. ♀	15⅕	13	2⅘
Trivandrum	ad. ♀	14⅗	13⅕	2⅘
Kurnool	ad. ♀	16	14⅘	2⅘
,,	ad. ♀	15⅕	14⅘	3
Palkonda Hills	ad. ♀	16	14	3
,,	ad. ♀	14⅖	14	3–
Vontimitta Range	ad. ♀	16	14⅖	3
Dharmapuri Range, Salem	ad. ♀	15⅗	14⅘	3

The weight of adult ♂ specimens is usually from 3 to 4 lbs., of ♀ specimens from 2 to 2¾ lbs.; but the ♂ from Madura was 6 lbs. and the ♀ from Ratnagiri 4 lbs.

Herpestes edwardsii lanka, Wrought.

Herpestes griseus, Kelaart, *Prodr. Faun. Zeyl.*, p. 41 (1852), (not of Geoffroy).

Mungos lanka, Wroughton, *Journ., Bomb. Nat. Hist. Soc.*, xxiv, p. 53 (1915).

Herpestes lanka, Phillips, *Man. Mamm. Ceylon,* p. 177 (1935).

Locality of type: Cheddikulam, N.P., Ceylon.
Distribution: Ceylon, 'confined to the low country dry zone' up to 500 ft. (Phillips).

Very closely resembling the South Indian race, but distinguished by having the contour hairs shorter and the speckling finer, the two features going together, and in being on the average less red on the head and feet and less richly tinted in the wool when the coat is unfaded.

Wroughton gave full specific rank to this Ceylonese representative of *edwardsii* because of the alleged absence of intergradation between it and the Indian specimens. Nevertheless the S. Indian race is obviously intermediate between the Ceylonese and the more northern Indian races, as might be expected. The two features Wroughton relied on for the status he assigned to *lanka* were the very fine grizzling and the absence of ferruginous tint from the face and feet. These characters hold good in the four skins in the British Museum, namely the type from Cheddikulum, N.P., November 12; two from Tammanewa, N.C.P., May 3 and 9; and one, undated, received from the Colombo Museum. These are very much alike, varying very slightly in the tint of the speckling, the practical identity in colour and coat between the November and May skins suggesting that the seasonal differences are slight. The coat in these specimens is only up to about 30 mm.; the wool is scanty and drabby grey in hue, without the ochreous tinge common in the S. Indian race, and there is no trace of red on the head, ears, feet or elsewhere. But sometimes there is no red in even dark coloured S. Indian skins, e.g. some from Travancore, and it has apparently faded out in some summer skins

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from the Eastern Ghats. Phillips, moreover, in his description of *lanka* says that the feet and head have a slightly reddish tinge. With regard to the redness all that can be said of *lanka* is that it is on the average less red than the S. Indian race.

The following flesh-measurements in English inches were recorded by Phillips:—

—	Head and body	Tail	Hind-foot
ad. ♂ : ...	18+	$13\frac{1}{8}$	3–
ad. ♀ : ...	$15\frac{1}{8}$	12	$2\frac{3}{5}$
av 4 ♀ : ...	14	$10\frac{4}{5}$	$2\frac{1}{2}$

The type of the race, a young adult ♂, is a little smaller than the largest ♀ in the British Museum from Tammanewa which agrees closely with Phillips's largest ♀.

SKULL MEASUREMENTS OF *H. edwardsii edwardsii* AND OF *H. edwardsii lanka*.

LOCALITY AND SEX	Cond. Bas. Length	Zygom. Width	Post Orb. Width	Int. Orb. Width	Max. Width	Mand. Length	pm^4	m_1
edwardsii								
Dharwar ad. ♂	81	42	14–	15	15	52	8– × 6–	7
,, (*carnaticus* type) ad. ♂	80	43	$13\frac{1}{2}$	16–	15+	52	8 × 6	7
S. Coorg ad. ♂	80	41	14	15	15	51	$7\frac{1}{2}$ × $5\frac{1}{2}$	7
,, ad. ♂	79	41	11	$14\frac{1}{2}$	14	53	7 × $5\frac{1}{2}$	7
Cochin yg. ad. ♂	80	40	14	15	15	51	7 × 4	7
Kurnool ad. ♂	86	44	13	16	16	55	8 × $5\frac{1}{2}$	7+
,, ad. ♂	80	42	11	15	15	53	8 × 5	7+
Palkonda Hills ad. ♂	81	39	13	15	15	52	7 × 5	7
,, ,, ad. ♂	77	39	12	14	15	50	7 × $5\frac{1}{2}$	7
Vontimitta Range ad. ♂	78	40	12	15	14	51	7 × 5	7
Salem ad. ♂	80	41	11	15	15	52	7 × 5	7–
Dharwar ad. ♀	76	36	12	13	12	49	7 × 5	7
,, ad. ♀	73	37	12	14–	13	46	7 × $4\frac{1}{2}$	6
S. Coorg ad. ♀	77	36	11	13	12	50	7 × 5	7–
Seringapatam ad. ♀	75	40	12	$14\frac{1}{2}$	14	...	7 × 5	...
Kurnool ad. ♀	76	39	11	14	14	48	7 × 5	7
Palkonda Hills ad ♀	74	38	12–	14	13	50	7– × $4\frac{1}{2}$	6
,, ,, ad. ♀	72	36	11	14	13	48	7 × 5	$6\frac{1}{2}$
,, ,, ad. ♀	68	35	13	13	$12\frac{1}{2}$	44	7 × 5	$6\frac{1}{2}$
Vontimitta Range ad ♀	76	37	13	14	13	49	$7\frac{1}{2}$ × 5	7
lanka								
Cheddikulam (type) yg. ad. ♂	79	40	13–	$14\frac{1}{2}$	15	51	8 × $5\frac{1}{2}$	7
,, (type) ad. ♀	72+	35	$11\frac{1}{2}$	$13\frac{1}{2}$	13	46	8 × 5	7

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Herpestes smithii, Gray.

For bibliography and synonymy see under the subspecies.

Distribution: Central and Southern India; Ceylon.

Very closely related to *H. edwardsii* but distinguished by its slightly larger size, the black-tipped tail, generally darker colour and generally more pronounced tendency to erythrism, although never so red as in the typical *ferrugineus* mutant of that species. In the slightly larger skull the occipital and sagittal crests are at least on the average less strongly developed.

Since I have seen no intermediates between *smithii* and *edwardsii* in the colour of the tail-tip, I adopt the prevalent view that they represent distinct species. But the colour of the tail-tip varies from black to pale individually in some African Mongooses. Hence in this case it may possibly indicate that *smithii*, being a jungle-form, is a 'habitat-mutant' of *edwardsii*.

In his revision of this species Thomas (*Journ., Bomb. Nat. Hist. Soc.*, xxviii, p. 23 (1921)] admitted five races:[1]—(1) the typical form, *smithii*, with *ellioti* and *torquatus* as synonyms, ranging from Hoshangabad to the Nilgiri Hills in Western India; (2) *jerdoni*, with *monticolus* as a synonym, from the Eastern Ghats; (3) *canens* from Mt. Abu in S.-W. Rajputana and Hazaribagh; (4) *rusanus* from Sambhar in Rajputana; (5) *zeylanius*, a substitute for the inadmissible name *rubiginosus*[2] adopted by Kelaart, from Ceylon. A few specimens from the Eastern Ghats have been received at the Museum since Thomas wrote, but I do not think his conclusions with regard to the Indian forms were justified by the material he had in his hands. On the available evidence it seems to me that the difference in colouration between his *smithii, canens* and *jerdoni* are due to seasonal changes in the coat; and his race *rusanus* was based upon a single specimen with a rather small skull. Hence I regard all the described Indian forms as representing a single race. I adopt, however, his name for Ceylonese specimens, which, on the average, appear to differ from the continental form.

The two races, here provisionally admitted, may be distinguished as follows:—

A. Tail longer, sometimes longer than head and body; more grey and less red on the average in the general colour (India) ... ... *smithii*.

B. Tail shorter, never so long as head and body; more red and less grey on the average in the general colour (Ceylon) ... ... *zeylanius*.

Herpestes smithii smithii, Gray.

Herpestes smithii, Gray, *Charlesw. Mag. Nat. Hist.*, i, p. 578 (1837); id. *Proc. Zool. Soc.* (1851), p. 131, pl. 30.

Calictis smithii, Gray, *Proc. Zool. Soc.* (1864), p. 565.

Herpestes ellioti, Blyth, *Journ., As. Soc. Beng.*, xx, p. 162 (1851).

Herpestes jerdonii, Gray, *Proc. Zool. Soc.* (1864), p. 550.

Herpestes torquatus (Elliot MS.), Kelaart, *Prodr. Faun. Zeyl.*, p. 40 (1852); Jerdon, *Mamm. Ind.*, p. 136 (1867).

Herpestes monticolus, Jerdon, *Mamm. Ind.*, p. 135 (1867).

Herpestes smithii rusanus and *canens*, Thomas, *Journ., Bomb. Nat. Hist. Soc.*, xxviii, p. 25 (1921).

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[1] He set aside *thysanurus*, applied by Wagner in 1839 to a Mongoose, with a black-tipped tail, said to have come from Kashmir, because no Mongoose with that character has since been recorded north of Rajputana. Wagner's record must nevertheless be borne in mind [*Münch., Gel. Anz.*, ix, p. 440 (1839) and *Säug., Suppl.*, ii, p. 301 (1841)].

[2] This name was given by Wagner to a specimen of *vitticollis* from the 'East Indies'. Both Kelaart and Blanford overlooked Wagner's statement, detected by Thomas, that the neck has a black mark on each side.

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Locality of type of *smithii* unknown; of *ellioti*, the Carnatic; of *jerdonii*, 'Madras'; of *torquatus*, 'S. India'; of *monticolus*, inland from Nellore; of *rusanus*, Sambhar, Rajputana; of *canens*, Mt. Abu, Rajputana.

Distribution: Central and Southern India from Rajputana, eastward to Bengal, and southwards through the Eastern and Western Ghats.

The type of *smithii* Gray has no definite locality, date or flesh-measurements, but there is no good reason to dissent from Thomas's decision that it came from somewhere near Bombay. It is no doubt an early winter skin, the contour hairs on the rump being about 53 mm. long and there is abundance of dark brownish under wool. The general colour is dark with black and greyish white speckling and a reddish cast traceable in the hairs of the upper side, particularly on the head, neck and between the shoulders; the fore leg is dark reddish brown, speckled and the hind leg is brighter red.

Satara (S. H. Prater). An adult ♂ collected at Mehda, January 11, is a very close match of the type in every respect and justifies Thomas's allocation of the latter; but a second ♂ skin from Mehda, January 13, differs in having the pale speckling of the back buffy with no appreciable red cast. A third, adult ♂ from Patan, December 11, is darker than the type, with buffy grey speckling and no appreciable red in the hairs.

Poona (P. H. Gosse). An adult ♂ from Khandala, 2,500 ft., April 14, has the coat a little longer than in the Satara skins, about 60 mm., but the under wool scantier than in them and in the type and the pale speckling is clearer whitish, especially strongly contrasted with the skin from Patan, but there is no red cast except towards the head and the legs are even darker than in the Patan skin. The later date of this skin suggests that the under wool is moulting and the pale speckling bleaching. It very closely resembles the skin from Kurnool in the Eastern Ghats referred to below.

Rajputana, Sambhar (Hume). The type of *rusanus* Thos., an ad. ♂, January 13, in winter coat, is indistinguishable in colour and coat from the Satara skins as Thomas stated; but two ad. ♂ from Mt. Abu (Crump), including the type of *canens* Thos., collected June 2 and 3, differ in having the coat harsh and thin with little or no underwool, the general colour paler and greyer, with the pale speckling bleached white, and no red cast, although there is, as usual, some ochreous before the black tail-tip. These skins closely resemble the skin from Salem in the Eastern Ghats mentioned below.

Hoshangabad, 2,500 ft. (Crump), an ad. ♂, March 9, in winter coat, closely resembles the skins from Sambhar and Satara; and a ♀ skin from Hazaribagh (Crump), May 2, in summer coat, is like the Mt. Abu skins but has some red on the head and nape and is more like the Salem skin.

Skins from the Eastern Ghats vary like those described above.

Hills inland of Nellore. The ♂ lectotype of *jerdoni* Gray (=*monticolus* Jerdon) is a soiled skin, formerly exhibited, with a thin, harsh, dead coat and no appreciable underwool. There is a little red on the muzzle and head, the merest trace on the neck but none elsewhere. A ♀ with the same history is a better skin, but the coat is thin with no wool, the general hue being grey with blackish brown speckling, and a little red on the head and muzzle and some yellowish or buff above the hock and close to the black tail-tip. A third old skin labelled 'Madras' is very similar to the preceding two. It was on the evidence of these three skins that Thomas separated *jerdoni* from typical *smithii*.

A series of summer skins collected by Baptista in the Palkonda Hills, 1,500 and 1,600 ft., in June and July and in the Vontimitta Range, 325 ft., August 8 to 11, are topotypes of *jerdoni* since these hills are inland of Nellore. The coat is long from about 50 to 55 mm. but, in accordance with the season, has at most only a little underwool. The general colours of the back may be tolerably clear grey or may show a paler or richer yellow cast representing apparently the red of some winter skins but bleached. One from Kondagorlapenta in the Palkonda Hills, July 17, closely matches the skin from the Shevaroy Hills described below except that the red behind the shoulders of the latter is replaced by ochreous. Another skin from Dasarladoddi, Palkonda Hills, June 26, has no red or yellow behind the shoulders. At Kurnool in Cuddapah Baptista collected two skins, one May 2, closely matching the skin from Salem, April 23, described below; the other April 27 is more iron-grey than the preceding, being speckled black and silvery grey with a faint buffish wash on the back and very little red in front.

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Shevaroy Hills (W. M. Daly). An unsexed, undated specimen with a full long coat, the contour hairs over 60 mm. and the tolerably abundant olivaceous wool 20 mm. General colour darker than in the preceding skins from the Eastern Ghats owing to the more intense black speckling, the red tint conspicuous on the head, neck, down the middle line of the back and increasing in amount and extent on the rump and outside of the thighs, also a good deal of it on the hind leg above and below the hock and on the fore leg from the elbow nearly to the wrist. Although this skin was in the Museum when Thomas revised *H. smithii*, he did not refer to it. It entirely negatives the distinction he drew between skins from the Western and Eastern Ghats. It obviously belongs to the same form as the type of *smithii* and the examples from Satara and its difference from the previously described skin from the Eastern Ghats is due to the coat being fresh and unfaded.

Salem, a little south of the Shevaroy Hills. A skin from Karumbapatti (Baptista), April 23, has the black speckling as in the Shevaroy skin and some red on the head and neck, but is not red elsewhere, showing a yellowish cast behind the neck on the upper side indicating incipience of bleaching as in some of the topotypes of *jerdoni*.

The flesh measurements in English inches and the weights of some specimens are as follows:—

—	Head and body.	Tail.	Hind foot.	Weight lbs.
Mt. Abu (*canens* type) ... ad. ♂	17 4/5	16 2/5	3 2/5	4
,, ... ad. ♂	17	17 3/5	3 1/5	3 3/4
Hoshangabad ... ad. ♂	16 4/5	16 2/5	3 3/5	3 1/2
Satara, Mehda ... ad. ♂	18 1/4	17 4/5	3 2/5	6
,, Patan ... ad. ♂	17 +	15 2/5	3 +	6
Poona, Khandala ... ad. ♂	16 1/2	15 1/5	3 2/5	...
Kurnool, Diguvametta ... ad. ♂	27 3/5	15	3 1/5	...
,, ,, ... ad. ♂	16	16 3/5	3 2/5	2 1/2
Palkonda Hills ... ad. ♂	17 1/5	16 1/5	3 2/5	4 1/4
Vontimitta Range ... ad. ♂	18	18 2/5	3 2/5	4
,, ,, ... ad. ♂	17 1/5	18 2/5	3 2/5	3 1/2
Hazaribagh, Bengal ... ad. ♀	15 4/5	16	3 +	...
Palkonda Hills ... ad. ♀	17 1/5	15 4/5	3 1/5	3 1/2

This table shows that the tail in this race is about as long as the head and body. It may be as much as about one inch longer or two inches shorter.

Herpestes smithii zeylanius, Thos.

Herpestes rubiginosus, Kelaart, *Prodr. Faun. Zeyl.*, p. 43 (1852). [Not *Crossarchus* (=*Herpestes*) *rubiginosus* Wagner.]

Herpestes smithi, Blanford, *Mamm. Brit. Ind.*, p. 126 (1888), (in part).

Herpestes smithii zeylanius, Thomas, *Journ., Bomb. Nat. Hist. Soc.*, xxviii, p. 23 (1921); Phillips, *Man. Mamm. Ceyl.*, p. 188 (1935), (misquoted as *zeylanicus*).

Locality of the type of *zeylanius*: Mankeni, E.P., Ceylon.
Distribution: Ceylon.

Rather doubtfully distinguishable from the typical continental Indian form by being a little darker on the average, never so grey as the greyest skins of the latter and the reddest a little redder, but some skins both 'grey' and 'red' practically indistinguishable from Indian skins. Also the tail seems to be relatively a little shorter.[1]

[1] Neither the flesh measurements nor the skulls bear out Thomas's statement that this race is larger than typical *smithii* from Western India.

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To the following list of the flesh measurements in English inches and weights of some specimens in the British Museum, I have added particulars of the dimensions recorded by Phillips.

—		Head and body	Tail	Hind-foot	Weight lbs.
Phillips's largest	ad. ♂	18 +	14½	3⅜	4¾
Wellegalli S. P.	ad. ♂	17⅜	15⅝	3½	4¼
Mankeni, E. P.	ad. ♂	17½	15	3	3¼
Matugama, W. P.	ad. ♂	16⅘	13½	3 +	—
Phillips's Aver. of 8	ad. ♂	16½	12½	3 +	3¾
,, largest	ad. ♀	16⅜	14⅜	3½	2¾
Ranna, S. P.	ad. ♀	16½	13½	3 +	—
Mankeni, E.P.	ad. ♀	15⅘	12⅘	3—	3
Kala Oya, N. W. P.	ad. ♀	14⅘	13½	3 +	2¾
Phillips Aver. of 2	ad. ♀	15½	13 +	3 +	2¾

Although the head and body are about the same length as in typical *smithii*, the tail is on the average shorter, and is always shorter than the head and body, nearly 4 in. in some cases. This also applies to several sub-adult additional specimens collected by E. W. Mayor which are not included in the table.

SKULL MEASUREMENTS OF *H. smithii smithii* AND *H. smithii zeylanius*.

NAME, LOCALITY AND SEX		Cond. Bas. Length	Zygom. Width	Post. Orb. Width	Int. Orb. Width	Max. Width	Mand. Length	pm^4	m_1
smithii									
Satara, Mehda	ad. ♂	90	45	13	17½	17	60—	8 ×6	7
Mt. Abu, Rajput. (*canens* type)	ad. ♂	88	46	15	19	18	57	8 × —	...
Satara, Patan	ad. ♂	86	45	13	16½	17	56	9 ×6	8—
Palkonda Hills	ad. ♂	86	45	14	17	16	57½	8 ×5	7
Poona, Khandala	ad. ♂	84	45	17	17	16½	56—	8 ×5½	7
Vontimitta Range just	ad. ♂	83	40	14	17	16	53	9 ×5	7½
Sambhar, Rajput. (*rusanus* type)	ad. ♂	82	44—	11	15	16	53½	8 ×5	7
Palkonda Hills	ad. ♀	86	46	14	17	16	56	8 ×6	7
Hazaribagh	ad. ♀	81	42	15	16	16	52	7½ ×5	7
Nilgiri Hills	ad. ♀	80	43	12	16	16	53	8 ×6	7
zeylanius									
Mankeni (type)	ad. ♂	89	49	15	19	19	59	9 ×6	8—
Matugama	ad. ♂	86	45	15	17	16	56	8½ ×5	8—
Kala Oya	ad. ♀	81	42	12	15	15	53	9 ×5	7½
Mankeni	ad. ♀	78	42	15	16	...	51	8 ×5½	7

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In these tables the skulls are enlisted to show the range in condylobasal length, regardless of geographical distribution. It will be noticed that the difference between the skulls of the type of *canens* and of *rusanus*, upon which Thomas relied for distinguishing the two alleged races is exactly the same as the difference between the two ♂ skulls of *H. edwardsii edwardsii* from Kurnool entered on the previous table (p. 225). It also shows that the skulls of the S. Indian *smithii* and the Ceylonese *zeylanius* are on the average noticeably a little larger than the skulls of *H. edwardsii edwardsii* and of *H. edwardsii lanka* which occur in the same areas respectively.

Herpestes smithii is the type of the genus *Calictis*, Gray [*Proc. Zool. Soc.* (1864), p. 564].

Herpestes fuscus, Waterhouse.

For bibliography and synonymy see under subspecific headings.

Distribution: S. India and Ceylon.

Size about the same on the average as *edwardsii* and *smithii* but the tail relatively considerably shorter, only about two-thirds the length of the head and body, the contour hairs less harsh and the upper half or third of the sole of the hind foot clothed with hair throughout the year. General colour very variable according to the subspecies, ranging from blackish brown with the dark bands in the contour hairs extensive and the white very narrow in the typical Indian race, to nearly uniformly ochreous or sandy with the dark bands reduced to fine, comparatively indistinct speckling in two of the Ceylonese races.

In its general form and the shape of the teeth, the skull is very like that of *edwardsii* and *smithii*, but it is typically less inflated in the frontal region so that the upper surface of the muzzle is a little less steeply sloped and may be slightly concave, the anterior tympanic portion of the bulla is smaller and the external crest a little better developed.

Analytical Key to the subspecies.

A. On the average a little larger and more uniformly dark brown above and especially below; the tip of the tail not lighter than the rest (S. India) ... ... *fuscus.*

B. On the average smaller and paler or brighter in hue, not so brown especially below; tip of the tail paler than the rest (Ceylon).

1. General colour darker, dark speckling conspicuous on the back, flanks and tail.
   a. Slightly smaller and less red ... ... *flavidens.*
   b. Slightly larger and redder ... ... *rubidior.*
2. General colour not so dark, the dark speckling not so conspicuous on the back, obsolete on the flanks and tail.
   a. Darker and redder, dark speckling on back blackish and more conspicuous ... ... *maccarthiae.*
   b. Paler, straw-coloured, dorsal speckling brown and faint ... ... *siccatus.*

Herpestes fuscus fuscus, Waterhouse.

Herpestes fuscus, Waterhouse, *Proc. Zool. Soc.* (1858), p. 55; Jerdon, *Mamm. Ind.*, p. 136 (1867); Anderson, *Anat. Zool. Res. Yunnan*, p. 184, pl. 8, figs. 1-2 (skull), (1875); Blanford, *Mamm. Brit. Ind.*, p. 127 (1888); and of subsequent authors.

Locality of the type: India.

Distribution: S. India, typically in the hills from 3,000 to nearly 6,000 ft.

Slightly larger on the average than the Ceylonese races, with a rather longer, fuller coat, the contour hairs of the rump from about 40 to 60 mm., and on the whole a little darker and less bright in colour, the general hue dark brown or blackish above, relieved by the fine buff or buff-grey speckling,

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the contour hairs with a small black tip and a narrow pale penultimate band and below the latter typically two very extensive black bands separated by a very narrow greyish one, these black bands always much wider than the pale, although the proportion varies individually to a certain extent; the wool olive brown at the summit, darker at the base; there is no red in the pelage, the head and tail being coloured approximately like the back, although the pale bands of the tail, the tip of which is like the rest, are often greyer and more extensive; the under side brownish, a little paler than the upper and not so speckled.

The following notes show the variations in the skins in the British Museum which on the whole form a very uniform series:—

S. Coorg, Virajpet, 3,000 ft. (Shortridge). An ad. ♂, January 30, is dark brown with fine buff speckling; an ad. ♀, January 27, is blacker with greyer buff speckling; the contour hairs being about 42 mm. in both.

Palni Hills, Tiger Shola, 5,700 ft. (McCann). An ad. ♂, April 24, is like the ♀ from Virajpet; an ad. ♀, April 27, is like the ♂ from Virajpet. The coat in the ♂ is about 64 mm., in the ♀ about 44 mm.

Madura, High Wavy Mt., 5,000 ft. (Prater), a skin like the ♂ from Virajpet, with the coat 46 mm.

Travancore, Primerd in Trivandrum, 3,800 ft. (Ferguson), one skin with the pale speckling rather finer and duller than in the preceding and the coat 53 mm.

Nilgiri Hills, Ootacamund (Gosse), July, a skin very similar to the ♂ from Virajpet, but the coat is 59 mm. and the underwool thinner.

'Madras' (Jerdon). An undated specimen, marked by Thomas as doubtless from the Nilgiris, is rather paler than the rest, owing to the pale bands of the contours, which are 40 mm. long, being noticeably wider. In this respect it is most strongly contrasted with the Travancore skin and with the type in which the speckling is fine and the general colour brown, with the contour hairs 42 mm. as in the ♂ from Virajpet.

The flesh measurements in English inches and weights of some specimens in the British Museum are as follows:—

—		Head and body.	Tail.	Hind-foot.	Weight lbs.
S. Coorg	... ad. ♂	19⅕	12⅘	3⅜	6
Madura	... ad. ♂	17⅕	12½	...	5
Palni Hills	... ad. ♂	16⅘	12	3	3
,,	... ad. ♂	14⅜	10	3	3
S. Coorg,	... ad. ♀	16⅘	12	3	3½

These dimensions suggest that Coorg specimens are on the average larger than those from the Palni Hills; but the data are insufficient to warrant the conclusion that more than one race is represented. The length of the head and body is larger on the average than in *H. edwardsii* and the tail is manifestly much shorter.

The skulls vary comparably to the skins. The two ♂ skulls entered in the table (p. 239) are not quite the largest and smallest in length and width. Actually the longest is the skull of the skin from Madura with a condylobasal length of 89 mm., and the shortest a second skull from the Palni Hills with the same length 82 mm. The widest is that of the type with a zygomatic width of 49 mm. and a maxillary width of 18 mm., the condylobasal length being 87 mm., very nearly the same as the ♂ from S. Coorg.

Herpestes fuscus flavidens, Kelaart.

Herpestes flavidens, Kelaart, *Journ., R. As. Soc. Ceylon*, ii, p. 323 (1850); id. *Journ., A. S. Soc. Beng.*, xx, p. 184 (1851); id. *Prodr. Fauna Zeyl.*, p. 44 (1852); Ryley, *Journ., Bomb. Nat. Hist. Soc.*, xxii, p. 106 (1914); Thomas, *Ann. Mag. Nat.* (9), xiii, p. 239 (1924); Phillips, *Man. Mamm. Ceylon*, p. 180 (1935).

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Herpestes fulvescens, Kelaart, *Journ., As. Soc. Bengal*, xx, p. 162 (1851) and xxi, p. 348 (1852); Blanford, *Mamm. Brit. Ind.*, p. 127 (1888), (in part).

? *Herpestes ceylanicus*, Nevill, *Taprobanian*, i, p. 62 (1887).

Herpestes flavidens ceylanicus, Thomas, *Ann. Mag. Nat. Hist.* (9), xiii, p. 240 (1924); Phillips, *Man. Mamm. Ceylon*, p. 186 (1935), (*ceylanicus*).

Herpestes flavidens phillipsii, Thomas, *Ann. Mag. Nat. Hist.* (9), xiii, p. 240 (1924).

Locality of types of *flavidens* and *fulvescens*, Kandy; of *ceylanicus*, Trincomalee; of *phillipsii*, Gammaduwa, E. Matale.

Distribution: Throughout the mountainous districts of the Central Province to over 6,000 ft., westwards to the coast near Colombo in the wet zone and eastward to Uva in the dry zone (Phillips).

A little smaller than the South Indian race, with the coat on the average shorter both on the body and tail and the pale speckling typically, but by no means aways, a little brighter, the under side usually not so brown and the tip of the tail as a rule brighter than its more proximal portion, its long hairs being more uniformly ochreous or reddish with obsolete black bands.

It was probably an examination of specimens of this race that induced Anderson to record *fuscus* as occurring in Ceylon. To this Blanford demurred on the grounds that *fuscus* was in his opinion replaced in Ceylon by *fulvescens* (=*flavidens*) which he regarded as a distinct species on account of its much smaller size. He was, however, unacquainted with the smaller specimens of *fuscus* and the larger Ceylonese specimens, subsequently collected, showing complete intergradation between the two in dimensions.

The following specimens in the British Museum, assigned to this race, show considerable variation in colour:—

Kandy. Two examples collected by White are topotypes of *flavidens*. An ad. ♂ from the 'neighbourhood of Kandy' (No. 77.11.1.1) is dark brownish in general hue, the contour hairs being almost ochreous, this tint becoming dominant towards the end of the tail which has the tip reddish. This specimen possibly resembles a specimen from Newera Eliya which Kelaart recorded as a 'much darker variety than the one from Kandy'.

Another ♂ (No. 77.3.14.3), labelled Kandy, is much paler because the black in the contour hairs is not so dark and the pale speckling not so richly tinted and a little more extensive. Both these skins are undated; but the difference between them may be seasonal.

Pattipola, C.P., 6,210 ft. Two ad. ♂ (E. W. Mayor), March 2 and 14, were identified by Thomas as *flavidens*. They closely resemble the second of the two Kandy skins recorded above but are a little darker and have the pale speckling a trifle finer, in both these respects coming a little nearer the first of the topotypical examples.

Mousakanda in Gammaduwa, E. Matale, C.P., 3,000 ft. An ad. ♂ (W. W. A. Phillips), August 20, is very like the specimen from Pattipola but has the pale speckling greyer not so yellow and the tail is not so reddish at the end. This example is the type of *phillipsii* Thos.; but according to Phillips *phillipsii* cannot be maintained because the pale olivaceous tint on which it was based is purely an individual feature. Probably the difference between it and the specimen from Pattipola is seasonal and due to bleaching of the Gammaduwa skin. A second specimen, November 12, from the same locality, tolerably closely resembles the Pattipola skins, but is a trifle darker.

Kumbukkan in Uva, ad. ♀ (E. W. Mayor), July 20, very closely matches the first described darker specimen from Kandy, but is a trifle darker, the two being more alike than are the two skins from Kandy, except that the tip of the tail in the Kumbukkan skin is like the rest of that organ and not dominantly reddish ochreous. This specimen was identified by Thomas as *ceylanicus* Nevill, the type of which came from Trincomalee. Phillips unfortunately was unable to examine specimens either from Kumbukkan or Trincomalee. He therefore followed Thomas and reproduced Nevill's description of *ceylanicus*. I can find nothing in Nevill's description of *ceylanicus* to distinguish it from *flavidens*; but the final relegation of *ceylanicus* to the synonymy of *flavidens* must await the discovery of additional examples from Trincomalee. At all events the Kumbukkan skin is more like the darker Kandy skin than are the skins from Pattipola and Gammaduwa.

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The following are the flesh measurements in English inches and weights of some specimens in the British Museum, supplemented by others taken from Phillips's volume:—

		Head and body	Tail	Hind-foot	Weight lbs.
Gammaduwa	ad. ♂	$16\frac{1}{5}$	$11\frac{2}{8}$	3–	2·2 oz.
Pattipola	ad. ♂	15	$11\frac{1}{5}$	3–	...
,,	ad. ♂	$14\frac{2}{8}$	$10\frac{4}{5}$	$2\frac{4}{5}$	2
Average of 5 (Phillips)	ad. ♂	15	10	3–	$2\frac{1}{2}$
Largest ,,	ad. ♂	$16\frac{1}{5}$	12-	3–	$3\frac{1}{2}$— $2\frac{1}{2}$
Kumbukkan	ad. ♀	$13\frac{4}{5}$	$11\frac{1}{5}$	$2\frac{3}{8}$	
Average of 4 (Phillips)	ad. ♀	13	9†	$2\frac{1}{2}$	1·11 oz.
Largest	ad. ♀	14	$9\frac{3}{8}$	$2\frac{4}{5}$	$1\frac{3}{4}$

The largest of these specimens are only a little smaller than the smallest of the South Indian race.

Herpestes fuscus rubidior, subsp. nov.

Herpestes flavidens maccarthiae, Thomas, *Ann. Mag. Nat. Hist.* (9), xiii, p. 239 (1924), (in part); Phillips, *Man. Mamm. Ceylon*, p. 184 (1935), (not *maccarthiae* Gray).

Locality of the type: Anasigalla, Matugama, W.P.

Distribution: 'Throughout the Kalutara District and the south-west of the island generally from about Panadura, 50 ft., in the Western Province to Matare and Tangalla in the Southern Province' (Phillips).

Distinguished from *flavidens* by being on the average a little larger and heavier and redder in its general colouring.

The one well preserved specimen known to me is the type, an ad. ♂ from Anasigalla Matugama, 100 ft. (W. W. A. Phillips), January 25, which was wrongly identified by Thomas as *maccarthiae*, Gray. The coat is full and longish, thicker if anything than in any of the above recorded skins of *flavidens* from high altitudes in the hilly region of Ceylon, and the general colouring, speckled red and black, is redder owing to the red rings in the contour hairs being a little more extensive and chestnut in hue; the tail is reddish at the end and the limbs are dark with fine pale speckling. The only other specimen assignable to this race that I have seen was collected at Yatiyantota, 500 ft., in the Southern Province (E. W. Mayor). It is a young, undated skin, faded and moulting, with many of the contour hairs shed especially on the belly. Hence the pale reddish speckling is not so conspicuous as in the type and is rather less extensive but the general hue is redder brown and paler than in the skins identified as *flavidens*.

In the adoption of this race I follow Phillips to whom it was well-known but, misled by Thomas, he identified it as *maccarthiae*, as recorded below.

The following flesh measurements in English inches and the weights of the type of this race are supplemented by others extracted from Phillips's records:—

		Head and Body	Tail	Hind-foot	Weight lbs.
Matugama (type)	ad. ♂	$16\frac{3}{8}$	$11\frac{2}{8}$	3	4
Largest (Phillips)	ad. ♂	$17\frac{4}{5}$	$12\frac{2}{8}$	$3\frac{1}{5}$	4
Average of 10 (Phillips)	ad. ♂	16	11–	3+	$3\frac{1}{4}$
Largest ,,	ad. ♀	$14\frac{4}{5}$	$10\frac{4}{5}$	$2\frac{1}{8}$+	$2\frac{1}{4}$
Average of 5 ,,	ad. ♀	$13\frac{1}{2}$	10+	$2\frac{1}{2}$	2

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It will be noted that Phillips's largest ♂ is as large on the average as ♂ examples of the S. Indian race and that his largest ♀ is about the size of the smallest ♂ of that race from the Palni Hills. The table also bears out Phillips's statement that *rubidior* is on the average a trifle larger than *flavidens*.

The skull of the type, the only one known to me, is just adult, the nasal and maxillary sutures being still open. It is nevertheless well developed with complete orbits, a relatively high sagittal crest and a constricted post-orbital area. As the table of measurements (p. 239) shows it is practically as large as the ♂ skulls of typical *fuscus* from the Palni Hills.

Herpestes fuscus maccarthiæ, Gray.

Cynictis maccarthiae, Gray, *Proc. Zool. Soc.* (1851), p. 131, pl. 31.
Onychogale maccarthiae, Gray, *Proc. Zool. Soc.* (1864), p. 570.
Herpestes flavidens maccarthiae, Thomas, *Ann. Mag. Nat. Hist.* (9), xiii, p. 239 (1924), (in part).
Not *Herpestes flavidens maccarthiae*, Phillips, *Man. Mamm. Ceylon*, p. 184 (1935), (see above).

Locality of the type: Jaffna, the northern point of Ceylon.

Distinguished from the preceding races by its generally more uniformly dark, reddish-ochreous hue above and below, the dorsal contour hairs being only indistinctly speckled with blackish, whereas those of the flanks, belly and tail show no dark speckling; legs darker, dark brown with pale speckling; underwool yellowish brown, nearly the same colour from base to summit.

No flesh measurements are available.

No doubt it was the peculiar colouration of this Mongoose, very different from that of other species of *Herpestes*, which induced Gray to assign it originally to *Cynictis*, a S. African genus with a tolerably uniform, tawny pelage. Neither Anderson nor Blanford paid any heed to the peculiarities of this Mongoose, dismissing them apparently as untrustworthy on account of the animal having been kept in captivity. Blanford also seems to have doubted the truth of Gray's statement that it came from Jaffna; but it is highly improbable that either Gray or the collector, Mr. McCarthy, invented that locality. Thomas, unfortunately, overlooked or ignored the record. If he had known it, he would probably have detected the differences between Gray's type and the specimen from S.-W. Ceylon which he identified as *maccarthiae* (see above) and its resemblance to his type of *siccatus*, which he believed to be from Mannar.

The skull of the type and only known specimen is comparatively small and poorly developed although fully adult. The orbits are incomplete behind and there is no sagittal crest, the temporal ridges forming a narrow lanceolate area on the forepart of the crown and a very low median ridge behind. Possibly the development of the skull was arrested by captivity conditions; but it shows none of the modifications which normally affect the skulls of Mongooses and other Carnivores when reared from cubhood in a menagerie.

This race of *fuscus* is the type of the genus *Onychogale* Gray [*Proc. Zool. Soc.* (1864), p. 570], a name suggested apparently, as Anderson surmised, by the longish claws of the fore foot due to the only known specimen having been kept in a cage.

Herpestes fuscus siccatus, Thomas.

Herpestes flavidens siccatus, Thomas, *Ann. Mag. Nat. Hist.* (9), xiii, p. 240 (1924); Phillips, *Man. Mamm. Ceylon*, p. 187 (1935).

Locality of type possibly Aripo near Mannar, N.P.

Most nearly resembling *maccarthiae*, but the general colour nearly uniformly sandy or straw-like with very faint brown speckling in the pelage of the back but more pronounced on the nape and head; the flanks, cheeks, belly and tail without dark speckling; the under fur dark, greyish brown at the base, yellowish at the summit; legs darker than the body, brownish speckled with yellow.

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The only known specimen, which has no skull or flesh measurements, was collected by Holdsworth and labelled Kandy; but since it is quite unlike other Mongooses from that district, Thomas suggested that it probably came from Aripo near Mannar on the north-west coast of Ceylon where Holdsworth is known to have secured other natural history material. This view is supported by the generally pale hue of the pelage which suggests an arid habitat. The skin looks like a bleached edition of the type of *maccarthiae* except for the sharp contrast between the dark base and the yellow summit of the under wool. In my opinion it is not unlikely that the types of these so-called races will prove to represent seasonal phases of a northern Ceylonese race, a view favoured by the locality of the type of *maccarthiae*; but I know of no other instance of such a marked seasonal difference in *Herpestes*.

Herpestes vitticollis, Bennett.

Herpestes vitticollis, Bennett, *Proc. Zool. Soc.* (1835), p. 67; and of subsequent authors including Blanford, *Mamm. Brit. Ind.*, p. 128 (1888); and Phillips, *Man. Mamm. Ceylon*, p. 190 (1936).

Crossarchus rubiginosus,[1] Wagner, *Schreber, Säug. Suppl.*, ii, p. 329.

Locality of type of *vitticollis*, Travancore; of *rubiginosus*, 'East Indies'.
Distribution: S. India and Ceylon.

One of the largest of the Oriental Mongooses invariably distinguishable by a black stripe running along the sides of the neck from behind the ear to the shoulder, composed of soft under fur and emphasized by the pale tips of the contour hairs above and below it. The tail, as in *fuscus*, is only about two-thirds the length of the head and body, but, unlike that species, the tip of the tail is black, the hind foot is naked below to the heel at all seasons and the contour hairs are long and coarse, 70-80 mm. on the rump, and variegated with from 5-10 coloured bands, usually a combination of whitish, black and chestnut red, the red especially prevalent and extensive on the tips of the dorsal contour hairs but very variable in its incidence and extent. The muzzle is typically blackish, the head black but grizzled; the chin and throat dusky and grizzled; the belly brownish or reddish, sometimes with grizzly speckling; the legs are mostly blackish and the wool of the back may be olivaceous grey throughout or yellow at the summit and black at the base.

The skull is considerably larger and altogether more robust, with deeper zygomatic arches, than that of the foregoing species; but the occipital and sagittal crests are less well developed so that the dorsal profile is more depressed and convexly curved behind. The greatest difference, however, lies in the large size, more conical shape and lower inferior projection of the posterior chamber of the bulla, a modification which results in the occipital condyles, the hamulars and the upper carnassial teeth being raised higher above a horizontal surface, when the skull rests upon it. A peculiarity of the teeth, which are more robust and less trenchant, is the presence of a distinct cingulum on the inner lobe of the first upper molar (m^1). There is also a trace of it on m^2.

This species is the type and sole representative of Gray's genus *Taeniogale* [*Proc. Zool. Soc.* (1864), p. 569].

The following account of some of the skins in the British Museum shows the colour-variations of this species:—

Travancore, Kolun. The *type* is reddish above from the nape backwards: on the fore body the hairs are extensively red at the tip, speckled brown

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[1] As pointed out above (p. 226) this name was wrongly assigned to the synonymy of *smithii* by Blanford following Kelaart, but correctly relegated to *vitticollis* by Thomas. Wagner described the neck as having a black spot on each side. In some skins the black stripe is reduced to a large spot when its two ends are concealed by the overlapping pale hairs above and below.

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and whitish below, but on the rump they are mostly red throughout with pale but no dark banding. Another from Travancore (Fry, No. 86.9.6.1), in good coat and colour, is, like the last, red from the nape to the black tail-tip but not so extensively, the hairs below being banded black and yellowish.

Palni Hills, Shambaganur, 6,000 ft. An ad. ♂. February 19, differs a little from Fry's Travancore specimen. It is red from the nape to the end of the tail, except for the tip, but there is not nearly so much red and the black and white speckling is everywhere more apparent.

S. Coorg, Wottekolle, 2,000 ft., January 2 and 5. An ad. ♂ and ♀ vary considerably. The ♂ has the fore back speckled yellow and black, not red as in the preceding specimens, but the hind back, rump, flanks and tail are extensively red and the fur of the back is yellow at the summit, black at the base. The ♀ is mostly dark grey above, the hairs banded black and white, not yellow, with buffish tips, but there is some red on the hair tips of the rump, thighs and tail; the flanks are grizzled, not nearly all red as in the ♂, and the fur is olive grey. The differences between these two skins, collected by Shortridge in the same place and at the same time of the year, are instructive. Another specimen from S. Coorg, an ad. ♂ from Srimangala, February 13, is intermediate in colour between the two from Wottekolle.

N. Kanara, Chipgeri, December 23, a ♂ is very like the ♀ from Wottekolle, the red setting in only on the rump.

Nilgiri Hills. A series of skins attests considerable variation. One is very like the ♂ from Wottekolle, another is practically all grey above, turning to yellowish on the rump, the others are intermediate between these two.

All the dated Indian skins, above described, as well as two from Haleri in N. Coorg, which are average in colouration, were collected between December and February. The differences in colouration are clearly not seasonal. On the other hand a series of five from Ceylon, namely three from Mousakanda, 3,000-3,400 ft., January 4 and October 8 (Phillips); one from Gammaduwa, 3,000 ft., August 8 (Phillips), and one from N. Eliya, May (Holdsworth), although extending over ten months of the year, are more uniformly coloured than the Indian set, having the hairs red at the tip from the head to the black tail-tip. It is worth noting that in the August skin from Gammaduwa the contour hairs are 80 mm., whereas in the January skins from S. Coorg they are barely 70 mm.

These Ceylon skins seem to bear out Blanford's idea that specimens from that island are on the average redder than those from S. India. There is no record, so far as I know, of skins from Ceylon showing hardly any red, like those from the Nilgiri Hills and N. Kanara. But none of the Ceylon skins is quite so red as the type of *vitticollis* from Travancore and they are not distinguishable from Fry's example from that district. Moreover the difference in 'redness' between the two skins from Wottekolle, S. Coorg, shows that colour-feature to be too variable to be relied on.

Some flesh measurements and weights are as follows:—

——		Head & Body	Tail	Hind-foot	Weight lbs.
South Coorg	... ad. ♂	$20\frac{4}{5}$	$13\frac{1}{5}$	4+	$7\frac{3}{4}$
,, ,,	... ad. ♂	$20\frac{4}{5}$	$12\frac{5}{6}$	4+	$6\frac{1}{4}$
Ceylon (Mousakanda)	... ad. ♂	$20\frac{3}{5}$	$11\frac{3}{5}$	$3\frac{2}{5}$	$5\frac{3}{4}$
,, ,,	.. ad. ♂	20	$12\frac{3}{5}$	$3\frac{4}{5}$	$6\frac{3}{4}$
South Coorg	... ad. ♀	$19\frac{1}{7}$	$12\frac{4}{5}$	$3\frac{3}{5}$	6
North Coorg	... ad. ♀	20	10	$3\frac{4}{5}$	...
,, ,,	... ad. ♀	17	12	$3\frac{4}{5}$	...
Ceylon	... ad. ♀	$19\frac{2}{5}$	$12\frac{1}{7}$	$3\frac{4}{5}$	$3\frac{3}{4}$
,, (aver. of 2)	... ad. ♀	$18\frac{1}{2}-$	12—	$3\frac{1}{2}$	...

On this list the measurements of the ♀ Ceylonese specimens are taken from Phillips's volume. The largest ♂ he recorded had a head and body length of 20 in. and the average of 4 ♂ was 19 in.; but there are two ad.

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♂ skins in the Museum sent by him from Gammaduwa and Mousakanda both of which measure 20⅗ in. in length of head and body. The dimensions exceed those of the previously described species, apart from some specimens of *H. edwardsii ferrugineus* from Kangra and Chamba, which are probably exaggerated. The weights also indicate a much more robust species as might be expected from the size of the skull, of which the dimensions are given below (p. 239).

Herpestes urva, Hodgson.

Gulo urva, Hodgson, *Journ., As. Soc. Beng.*, v, p. 238 (1836).
Urva cancrivora, Hodgson, *Journ., As. Soc. Beng.*, vi, pp. 561-4.
Mesobema cancrivora, Hodgson, *Journ., As. Soc. Beng.*, x, p. 910.
Herpestes urva, Anderson, *Zool. Res. Yunnan*, p. 189, pl. 9, figs. 5 and 6 (1878); Blanford, *Mamm. Brit. Ind.*, p. 129 (1888); and subsequent authors including G. M. Allen, *Amer. Mus. Novit.*, No. 359, p. 8 (1929).
Urva hanensis, Matschie in Filchner's *Exp. China-Tibet*, p. 190 (1907).
Herpestes urva annamensis, formosanus and *sinensis*, Bechthold, *Zeitschr. Säug.*, xi, pp. 150-2 (1936).

Locality of type of *urva* and *cancrivora*, Nepal; of *hanensis*, Hankow; of *annamensis*, Phu Qui, Annam; of *formosanus*, Formosa; of *sinensis*, Kuang-tung.
Distribution: Nepal, Assam and Burma to S. China including Formosa and Hainan, Laos, Tonkin, Annam and the northern part of the Malay Peninsula.

A large Mongoose with a comparatively short tail, not more than two-thirds the length of the head and body, a stripe of white contour hairs extending from the corner of the mouth to the shoulder and the sole of the hind foot hairy nearly down to the hallux. General colour above black and white, the contour hairs white at the tip to a varying extent, when extensive giving a 'badger-like' appearance to the pelage, the subterminal band extensively black, the under hair ochreous or rusty, dark grey close to the skin; tail with its base like the back but becoming progressively ochreous or flavous towards the tip; head blackish or brown, speckled, contrasted with the brown muzzle; belly brown, speckled, some black on the chest and hind throat, but fore throat, chin and lower cheek white; legs black with very little speckling.

Skull much more robust than in *edwardsii*, *smithii*, and *fuscus*, its dorsal profile very like that of *vitticollis*, the occipital and sagittal crests being weak so that it is sloped posteriorly, but the bullae and teeth, although the teeth are a little larger, much as in the three first mentioned species.

In addition to *Urva* and *Mesobema*, quoted above, a third generic name *Osmetectis* Gray [*Ann. Mag. Nat. Hist.*, x, p. 260 (1842)] was assigned to this Mongoose by Anderson in 1879 and, following him, by Thomas in 1882. The reference is unintelligible. Gray proposed *Osmetectis* for an animal he had previously named *Viverra fusca* [*Hardw. Illustr. Ind. Zool.*, i, pl. 5 (1830)]. The figure most emphatically does not represent a Mongoose of any kind. It has an elongated snout and cat-like feet and was possibly taken from a skin of the Nepalese Palm Civet (*Paguma larvata grayi*); but at best it is a caricature.

The following notes on skins in the British Museum are added to show the individual variation, seasonal and otherwise, and to justify the synonymy given above:—

Nepal. Four of Hodgson's specimens show great variation in colour. One is well coloured, the contour hairs 58 mm., being black and whitish, the plentiful wool bright buff, or ochreous at the summit, dull brown at the base; the hairs of the ventral surface are brown turning to grey at the base; the legs blackish with a little pale speckling above the paws; the tail like the back at the base but more and more ochreous towards the tip, but the hairs are short and broken here and may have been grey-tipped. A second, marked cotype, is a moulting skin in dead coat, with the wool quite pale yellowish white at the summit and the tail not nearly so ochreous. A third, also a cotype, is like the last but has the legs chocolate and the dark bands of the contour hairs deep brown, not so black. The last offers the greatest contrast

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to the first, there being no yellow in the contour hairs or in the wool which is sooty grey; the hairs of the tail are yellowish grey at the base, then black with a grey tip.

Of two from Gorkha, Nepal (Baptista), one, November 26, agrees closely with Hodgson's first; the other, December 20, has the white tips of the contour hairs more extensive and the wool not quite so rich. Another from Nepal (Inglis) is duller in its wool, like Hodgson's cotypes.

Darjiling. A skin from Pashok (Crump), 3,000 ft., October 6, is like the Gorkha skin of December 20. One from Hasimara, Bhutan Duars, 600 ft., February 23, closely matches Hodgson's richly coloured skin; but one from Rajapara, S. Kamrup, 600 ft., November 17, has very little bright tint, except on the tail-tip, and fits in with Hodgson's duller skins. So also does one from Tura in the Garo Hills, 1,300 ft., the date being uncertain.

An undated skin from Sadya, N.-E. Assam, has a full long coat, about 70 mm., and has the rich ochreous under colour of the Darjiling skin, but the tips of the contours are more extensively white.

Burma. An undated skin from north of Mogaung, near the source of the Chindwin River (Capt. Abbey), is well coloured like the skin from Sadya, but has the under colour darker almost rusty ochreous, a yellow wash on the tips of the contour hairs of the back and the hairs of the tail mainly ochreous. One from the Chin Hills, November 13 (Hopwood) is very different from the last, being dull coloured with the wool drabby and the white tips of the contours small. One from 20 miles north-west of Kindat, 600 ft. (Mackenzie), April 19, is apparently moulting, there being no wool on the back but abundance on the flanks and purplish grey in colour. An ad. ♂ from Thandaung, near Toungoo, 4,500 ft., April 7, is very like the skin from Sadya, with a similar faint yellow wash and almost ferruginous-tipped wool. This skin also resembles the brightest of the Nepal series; but one from Tharawaddy agrees very well in colour with the duller Nepalese skins, although the coat has only a little greyish wool. Finally a skin from Rangoon, March 7, has the contour hairs black and white and 70 mm. long and the wool rather dull, greyish buff.

The above described skins ranging from Nepal to S. Burma in British Indian territory are broadly speaking so much alike and show so many cross resemblances in localities remote from each other that it is impossible to sort them into local races. The same applies to all the other skins in the British Museum from adjoining countries outside those limits. One from Xien Quang Koo, Laos, January 10; five from Backan Tonkin, 500 ft., December 17 to January 11; one from Phu Qui, Annam, 100 ft., the type of *annamensis*, Bechth., all collected by Delacour and Lowe and correctly, in my opinion, identified by Thomas and Osgood [*Field. Mus. N. H. Zool.*, xviii, p. 260 (1912)] as typical *urva*, are in well coloured winter coat and are inseparable from N. Indian and Burmese skins. Also the following Chinese skins, one undated from Tengyueh, Yunnan (Howell); and one from Foochow, March; one from Fokien, January 7; one from Chung Yang, S. Hupeh, January; one from Chinteh, Anhwei (Nyanhwei), May; and three from Bankoro, Formosa, fit in with the Indo-Chinese, Burmese and Indian skins. The Chinese skins have a bearing on the synonymy I have given of *H. urva*. Hankow, the type locality of *hanensis*, Matschie, lies between Hupeh and Anhwei and the likeness between my skins from these two districts and Indian and Burmese skins of typical *urva* confirms G. M. Allen's opinion that the alleged distinctive characters of *hanensis* have no systematic value. My two skins from Fokien, whence Allen had a good series, also support this view that the Crab-eating Mongoose of that district is inseparable from typical *urva*; and the agreement between the Fokien and Tonkin skins hardly admits of a doubt that the Kuangtung skins, described by Bechthold as *sinensis*, represent the same Mongoose. Three skins from Formosa in the British Museum I am unable to distinguish by any reliable character from Hodgson's Nepalese series. The alleged difference in the coat on which Bechthold relied when describing *formosanus* is probably seasonal, if existent. At all events in immature specimens from Formosa the contour hairs of the rump are 65 mm., whereas in two adult Nepalese specimens in good coat they are respectively 62 and 72 mm.

Very few flesh measurements of ad. ♂ specimens are available in the Museum material and none from the typical locality of *H. urva*. To the

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measurements of British Indian specimens have been added a few recorded by Delacour and Lowe from Indo-China.

——		Head and Body	Tail	Hind foot
Backan, Tonkin	... ad. ♂	22	12⅘	4 —
Toungoo, Burma	... ad. ♂	20⅕	13⅗	4 +
Gorkha, Nepal	... ad. ♀♀	20⅜	12⅘	4 +
,, ,,	... ad. ♀	18⅘	12⅘	4 —
Toungoo, Burma	... ad. ♀♀	19⅕	12⅕	4 +
Backan, Tonkin	... ad. ♀♀	20⅘	12⅕	4 —
Phu Qui, Annam	... ad. ♀	18⅕	11⅜	3⅘

There is very little difference between the sexes. It may be noted that the two ♀ specimens from Nepal agree respectively very closely with the two from Indo-China. Of the latter the one from Annam is the type of *annamensis*, Becht.

The weight of one of Mackenzie's Tonghoo specimens, a ♀ with the head and body 18 in., was 4½ lb. The weight of an ad. ♂ would no doubt be at least 6 lb. or over.

SKULL MEASUREMENTS OF *H. fuscus, H. vitticollis* and *H. urva*.

NAME, LOCALITY AND SEX	Cond. Bas. Length	Zygom. Width	Post. Orb. Width	Int. Orb. Width	Max. Width	Mand. Length	pm^4	m_1
H. fuscus fuscus								
Madura, Highwavy Mt. ad. ♂	89	48	16	18	18	61	9 × 6	8
S. Coorg, Virajpet ad. ♂	88	47	15	18	17	59	8 × 6	7
Palni Hills, Tiger Shola ad. ♂	83	44	15—	—	16	55	8 × 5½	8—
H. fuscus rubidior								
Anasigalla (type) ad. ♂	83	43	13	16	15+	54	7 × 5	7
H. fuscus flavidens								
Kandy yg. ad ♂	79	42	13	15	15	53	7½ × 5½	7
Mousakanda yg. ad. ♂	75	38	14	14	15	50	7¼ × 5	7
Kumbukkan ad. ♀	75	40	13	15	13½	48	7 × 5	6
H. fuscus maccarthiae								
Jaffna (type) ad. ♀	71	37	13	14 –	13	—	7½ × 5	–
H. vitticollis								
S. Coorg, Wottekolle ad. ♂	103	58	19	22	22	72	10 × 7½	9+
N. Coorg, Haleri ad. ♀	98	54	20	21	21	70	9¼ × 8	9½
Ceylon, Gammaduwa ad. ♂	100	57	19	23	21	71	10 × 7	9
H. urva								
Burma, Ruby mines ad. ♂	98	56	17½	20	20	67	9 × 6½	9+
,, Toungoo ad. ♂	97	56	15	21	21	69	9 × 7	9—
Nepal, Gorkha ad. ♀♀	95	54	13½	18	19	65	9 × 6½	9—
,, ,, ad. ♀	90	52½	15	20	19	63	9 × 7	9

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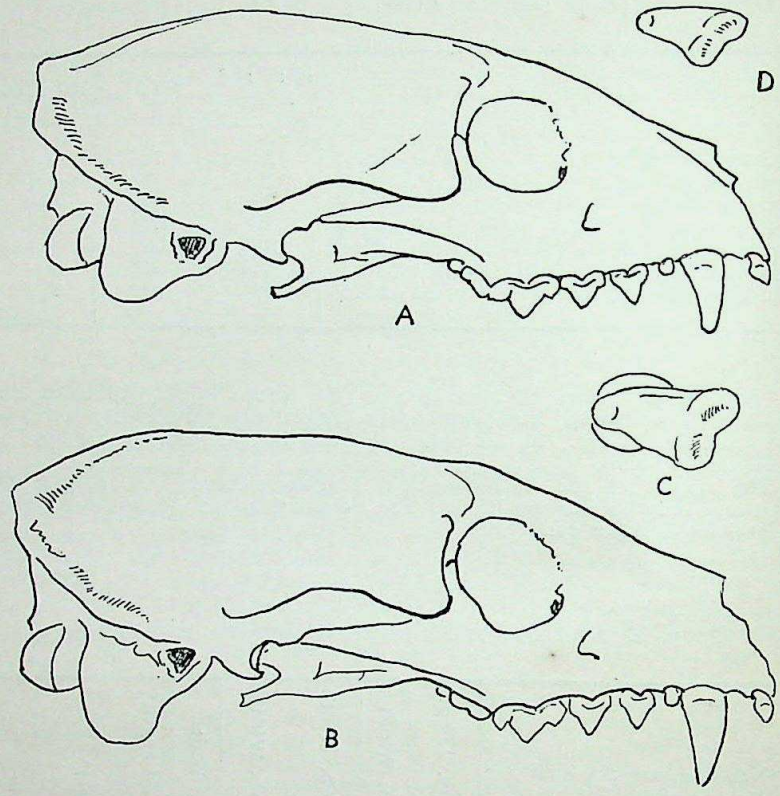

Fig. 2.—A. Skull of adult ♂ of *Herpestes urva* from the Ruby Mines, Burma.
B. Skull of adult ♂ of *Herpestes vitticollis* from S. Coorg.
C. First upper molar of left side of *Herpestes vitticollis*.
D. The same of *Herpestes edwardsii nyula*.

Herpestes javanicus, Geoffroy.

Ichneumon javanicus, Geoffroy, *Descr. de l'Egypte. Hist. Nat.*, ii, p. 138 (1812).

Distribution: From Persia, through Northern India and Burma to Indo-China, Hainan, Siam, the Malay Peninsula and Java.

In the British Indian representatives of this species the size is small, with the tail always shorter than the head and body but usually over two-thirds the length; the coat is always short and soft to silky, when fresh, and although the general colour is variable seasonally and individually, the speckling is always fine, the contour hairs having as a rule only five rings of which two are pale; the under wool is characteristically yellow at the summit and black at the base and the legs are about the same tint as the body with the paws often paler.

In its general shape the skull is like that of *H. edwardsii* without the bulging forehead and the posterior chamber of the bulla is less inflated and scarcely projects below the anterior.

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Although there is a great difference not only in size but in colour between the western race of this species, *pallipes*, and the eastern race, *javanicus*, the two are linked by intermediate forms, the Burmese race *birmanicus* coming very close to the Malayan race, *perakensis*, which connects it with the Siamese and Indo-Chinese race, *exilis*, the latter being similarly closely related to the typical Javan race *javanicus*, the largest of all, very nearly as large as *H. edwardsii*. The Indian and Burmese races differ from those found to the east and south-east of Burma in Continental Asia by being a little smaller, by having the crown of the head the same or almost the same tint as the body and by the complete absence of red in the pelage. In the others the head is at least darker, is nearly always some shade of red and redness is a very prevalent feature on the body and tail.

Herpestes javanicus auropunctatus, Hodgs.

Mangusta auropunctata, Hodgson, *Journ., As. Soc. Beng.*, v, p. 235 (1836).
Herpestes nepalensis, Gray, *Charlesw. Mag. Nat. Hist.*, i, p. 578 (1837).
Herpestes auropunctatus, Blanford, *Mamm. Brit. Ind.*, p. 121 (1888), (in part, excluding *pallipes* and *persicus*).
Mungos auropunctatus auropunctatus and *H. nepalensis*, Wroughton, *Journ., Bomb. Nat. Hist. Soc.*, xxvi, pp. 54-5 (1918).

Locality of type of *auropunctatus*, Nepal; of *nepalensis*, 'N. India' (Hodgson).
Distribution: N. India from Kashmir to Bhutan; Assam, Manipur and Bengal, south of the Ganges as far south as Chilka in Orissa.

Distinguished from the previously described British Indian Mongooses by its smaller size and shorter coat, the contour hairs in winter being at most up to about 20 mm. long, very soft and speckled with about five alternating bands; also by the legs being about the same tint as the body with the paws often a little paler than the areas above them, at all events not darker. The general colour varies considerably according to the season, but the speckling of the contour hairs is always fine, although more extensive when the coat is longer; the wool when fully grown is fairly abundant, dark at the base, pale at the summit and the tip of the tail does not differ conspicuously from the rest of the organ.

These characters apply in general to the other two British Indian races of *javanicus* in which, as in *auropunctatus*, the tail is considerably shorter than the head and body.

The following account of some skins in the British Museum attests great individual variation in colour.

Nepal. Eight undated skins (Hodgson), vary greatly in length of coat, amount of under wool and colour, the differences being no doubt seasonal. No two skins are exactly alike, the greatest contrast being between one (No. 43.1.12.124) in which the general tint is dark brown, with minute, nearly ochreous speckling, the contour hairs being short, the scanty wool brownish, and another (No. 43.1.12.20) which is comparatively pale, the pale speckling of the contour hairs being much more extensive and buffy grey to whitish and the more luxuriant wool greyish yellow at the summit, dark grey at the base. The first no doubt represents the new summer coat, the second the bleached winter coat. Another phase is shown by a skin (No. 45.1.8.321) which is pale brown, with fine grey speckling. The best coated of the series (No. 43.1.12.22) has the contour hairs about 20 mm., boldly speckled buffy yellow and blackish, with the wool ochreous at the summit, blackish brown at the base; the tail greyer than the body, the legs like the body, with the paws a little paler and unspeckled, the under side drabby, the hairs of the abdomen being browner at the base and showing some dark speckling. This skin exhibits, I believe, the unfaded winter coat. The rest of the skins differ in various details, linking those above described; and the type of *nepalensis*, Gray, also one of Hodgson's skins, regarded by Wroughton as representing a distinct 'species', fits in with the shorter coated, more finely speckled examples.

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Of Nepalese skins from precise localities, one from Khatmandu (Scully), March, closely resembles Hodgson's (43.1.12.22) several from Gorkha (Baptista), November 30 to March 21, and two from Yodaveri, 7,000 ft. (Kennion), November 16, agree essentially with Hodgson's series, Kennion's skins being comparatively short coated and finely speckled.

Kashmir. Five skins resemble the Nepalese and show similar variations. One (Ward) without special locality, 6,300 ft., September 13, has the coat 13 mm., with very little, nearly uniformly dark grey under wool. One from Tral, 5,800 ft. (Stockley), October 7, has the coat 16 mm. Two from Kajerskote, 5,500 ft. (Ward), January 12 and 22, have the coat 20 mm., and in other respects resemble the March skin from Khatmandu and Hodgson's (43.1.12.22), and one from Manarsbal, Wular Lake (Dunn), May 31, has the coat short, 14 mm. and the pale speckling of the contour hairs greyish.

From countries to the east of Nepal there are skins from Hasimara in Bhutan Duars, 600 ft. (Baptista), November 18 to February 28, which generally agree with the Nepal series, one skin being much darker than the others; one from Cooch Behar, March, is speckled silvery and black, a little paler than Hodgson's palest but obviously the same; five from Angarakata in N. Kamrup, Assam, 300 ft., December 23 to February 28, are like the specimens from Bhutan and Gorkha in Nepal; two from Golaghat, Assam, 250-300 ft., January 13 and 26, have the pale speckling yellowish white to white, one, the whiter of the two, which closely matches the Cooch Behar skin, has some almost wholly white hairs on the nape and fore back, giving these areas a hoary aspect; one, undated, from Dilkoosha in Cachar, almost exactly matches the skins from Gorkha in Nepal; whereas one from the Jaintia Hills, 3,000 ft., July 26, with the coat very short, finely speckled with buff and the wool uniformly dark, is like the skins from Yodaveri in Nepal. Finally a skin from Manipur (Hume), March 11, identified by Blanford as *birmanicus*, has the coat full, 20 mm. long, and only differs from the example of typical *auropunctatus* from Khatmandu, also collected in March, in having the pale speckling a trifle yellower, less ochreous.

There are three skins from localities south of the Ganges in N.-E. India. A ♂ from Midnapore, 200 ft., September 11, has the coat thin and short, the general colour darkish, with very fine yellowish or buff speckling, the wool very scanty and mostly grey, the two normal tints being merely slightly indicated. A ♀ from Nimiaghat, Hazaribagh, 1,000 ft., June 12, is as finely speckled as the Midnapore skin, the coat being equally thin and short, but the general colour is paler and yellower, the pale speckling being richer in hue and the dark speckling browner, not so black. The third, a ♀ from Satpara Puridish in Orissa (Chilka Survey), is undated but is in good coat and in its whitish pale speckling and in the tint of its well developed under fur it closely matches Hodgson's pale speckled Nepalese skins. The well marked differences between these three skins are probably merely seasonal and there is no evidence that they are either separately or collectively racially distinct from *auropunctatus*.

This race under the name *nepalensis* is the type of the genus *Calogale* Gray [*Proc. Zool. Soc.* (1864), p. 560].

It was this small Mongoose, not *H. edwardsii* as formerly supposed, that was introduced into the West Indies, and is now found in most of the islands, the British Museum having specimens from Jamaica, St. Lucia, Barbados and elsewhere. This was pointed out by G. M. Allen [*Bull. Mus. Comp. Zool.*, liv, p. 217 (1911)] who identified his specimens as *Herpestes birmanicus* and told the story of the shipment of the original consignment from Calcutta to Jamaica.

Herpestes javanicus pallipes, Blyth.

Mangusta pallipes, Blyth, *Journ., As. Soc. Beng.*, xiv, p. 346 (1845) and xv, p. 169 (1846).

Herpestes persicus, Gray, *Proc. Zool. Soc.* (1864), p. 554.

Herpestes auropunctatus, Blanford, *Mamm. Brit. Ind.*, p. 121 (1888), (in part).

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Mungos auropunctatus helvus, Ryley, *Journ., Bomb. Nat. Hist. Soc.*, xxii, p. 661 (1914).

Mungos auropunctatus pallipes and *helvus*, Wroughton, *Journ., Bomb. Nat. Hist. Soc.*, xxvi, pp. 54-5 (1918).

Locality of the type of *pallipes*, Kandahar; of *persicus*, Khuzistan and Mohammerah, W. Persia; of *helvus*, Deesa in Palanpur, N. Gujerat.

Distribution: The deserts of N.-W. India; Afghanistan; Persia.

Distinguished on the average from *auropunctatus* by its paler, generally greyer colour above and usually whiter colour below.

The following account of some of the skins in the British Museum affords justification for the synonymy given above:—

Afghanistan. Three skins from Kandahar, topotypes of *pallipes* Blyth, collected by Hutton and St. John, and one labelled Afghanistan collected by Griffiths and also probably a topotype, vary considerably in colour. Griffiths' skin is darkish, olivaceous, speckled brownish black and buffy, with normally tinted wool and the coat 17 mm. Of the three skins from Kandahar, two have the coat the same length and the wool the same colour as in Griffiths's skin, but the general colouration is much lighter, owing to the whitish speckling, the speckling being broader in one than the other. This specimen, dated February 2, shows that the others, with similar coat and wool, are winter skins, but Hutton's Kandahar skin, with the coat only 10 mm., and indifferently speckled, the wool very short and yellowish olive showing between the thinned contour hairs, is obviously moulting.

A skin from Seistan on the Perso-Afghan border (Kennion) is almost an exact match of St. John's Kandahar skins; the co-types of *persicus* from Khuzistan and Mohammerah, near the head of the Persian Gulf, similarly resemble Griffiths's Afghan skin and two from Mesopotamia are respectively like Griffiths's and one of St. John's Kandahar skins. These data show that *persicus* is a synonym of *pallipes* as Blanford maintained. Wroughton gave no reasons for his opinion that *persicus* is distinct.

A very large number of skins collected from the deserts of N.-W. India, principally in Sind by Prater and McCann for the Survey, was correctly identified as *pallipes* by Wroughton and others. Of these a series from Tatta, Gharo, Keti, Bagan on the Indus, Bohara near Karachi, is dark and brownish grey in hue, although varying individually; several from Gambat in Khairpur, April 6 to 10, are darkish grey or paler like the Afghan skins. Of four skins from Larkhana, one, March 22, is grey and matches St. John's Kandahar skins; the others, May 9, are dark skins in bad coat like the brownish skins from the Karachi district; and one from Jacobabad, February 27, is like the two pale Kandahar skins and the one from Seistan, and the same applies to a skin from the Salt Range in the Upper Punjab, March 12. Finally seven more or less faded skins, collected by Crump at Deesa, Palanpur, 450 ft., April 25 to May 5, were described by Ryley as *helvus*. This race was adopted by Wroughton; but three at least of the better coloured skins almost exactly match the skin from Seistan and may be described as slightly faded editions of St. John's topotypes of *pallipes*. The type of *helvus*, May 5, has the dark speckling still more faded and the partial exposure of the wool by the thinning of the contour hairs helps to give the yellowish appearance upon which the race was based. Another has the moult of the contour hairs still further advanced and is yellower than the type. The evidence that *helvus* is a valid race is in my opinion negligible.

Some skins from Gwalior (Riley O'Brien) agree on the whole better with this race than with *auropunctatus*.

Herpestes javanicus birmanicus, Thomas.

Herpestes birmanicus, Thomas, *Ann. Mag. Nat. Hist.* (5), xvii, p. 84 (1886) and *Proc. Zool. Soc.* (1886), p. 58; Blanford, *Mamm. Brit. Ind.*, p. 122 (1888); Wroughton, *Journ., Bomb. Nat. Hist. Soc.*, xxvi, pp. 54-5 (1918).

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Locality of the type: Pegu.
Distribution: Lower Burma from Toungoo to Tenasserim.

Distinguished from *auropunctatus* of Northern India and Assam by its slightly larger average size indicated particularly by the skull.

Although regarded as a distinct species by Thomas, Blanford and Wroughton, this Mongoose is clearly nothing but a local race akin to the typical North Indian form *auropunctatus*, with which it completely intergrades. Blanford indeed recorded it from Manipur and Cachar, but for what reason is not clear. The only skin from Cachar I have seen is inseparable from Nepalese specimens, although it exactly matches in colour the type of *birmanicus* from Pegu (Oates), April 10.

A series of nine skins from Toungoo, 100 ft. (J. M. D. MacKenzie), May 23 to August 16, shows considerable variation in colour, some closely agreeing with the type. Most of them, dating from May 26 to June 13, have short coats, are dark brown in colour, with fine pale ochreous speckling, the wool scanty and not noticeably bicolor and closely resemble the skins of *auropunctatus* from Yodaveri in Nepal; but one, May 23, is much lighter, with less black and paler yellowish speckling almost exactly as in typical *nepalensis*, and another, August 16, is lighter than the last, has a longer coat and consequently more extensive pale speckling, which is also rather brighter yellow, and the wool is beginning to be differentiated into the two normal tints. Finally one from the Sittang delta, 40 miles south of Pegu, March 4, is yellower than any, with a longer coat and broader pale bands, normally bicolour wool, in all respects nearly matching the better coloured of Hodgson's Nepalese series.

Flesh measurements in English inches of some specimens of the three races of this species are as follows:—

		Head and Body	Tail	Hind foot
auropunctatus				
Bhutan Duars	... ad. ♂	13⅕	10⅕	2⅝
Kajetrsgkote, Kashmir	... ad. ♂	12⅘	10⅘	2⅝
Gorkha, Nepal	... ad. ♀	12½	9⅝	2⅕
Bhutan Duars	... ad. ♀	11⅜	9⅜	2+
pallipes				
Larkhana, Sind	... ad. ♂	12½	9⅕	1⅘
Palanpur, Gujerat	... ad. ♂	12+	10⅜	2
,, ,,	... ad. ♀	11½	9⅖	1⅘
Larkhana, Sind	... ad. ♀	10⅜	8⅜	1⅜
birmanicus				
Tounghoo	... ad. ♂	14⅘	11⅜	2½
,,	... ad. ♂	13⅘	9	2⅕
,,	... ad. ♀	12⅘	10	2+

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SKULL MEASUREMENTS OF THE BRITISH INDIAN SUBSPECIES OF *Herpestes javanicus*.

NAME, LOCALITY AND SEX	Cond. Bas. Length	Zygom. Width	Post. Orb. Width	Int. Orb. Width	Max. Width	Mand. Length	pm^4	m_1
auropunctatus								
Kajersgkote, Kashmir ad. ♂	66	34	10	13	12	42½	6 × 5	6
Nepal ad. ♂	62	30	12	12	11½	40	6 × 5	6
Bhutan Duars ad. ♂	66	33	10	11	11	43	6 × 4	6–
,, ,, ad. ♂	61	31–	9	11–	11–	40	6 × 4½	5½
Orissa, Khurdu ad. ♂	59	30	10	11	10	...	6 × 4	...
Nepal, Ghorka ad. ♀	63	31	10½	10½	11	41	6 × 5	6–
Bhutan Duars ad. ♀	61	29	10½	11	10½	38½	6 × 4	6
,, ,, ad. ♀	57	30	9	10	10	...	6 × 4	...
Orissa, Satpara ad. ♀	63	30	12¼	11	11	40	6 × 4	5
pallipes								
Kandahar ad. ♂	66	34	9	12	12	43	7 × 4½	6
Persia (*persicus* co-type) ad. ♂	(63 ±)	32	10–	12	12–	...	6 × 4¾	...
Gwalior ad. ♂	65	33	9	11½	12	42	6 × 5–	5½
Palanpur (*helvus* type) yg. ad. ♂	63	30	10	11–	10½	40	7 × 5	6
,, ,, ad. ♂	58	30	10	11	11	37	6 × 4	6–
Sind, Sukkur ad. ♂	58	30	9	11–	11–	...	6 × 4	...
Palanpur ad ♀	57	29	8¼	10	10	35	6 × 4	5
birmanicus								
Pegu (type) ad. ♂	67	34	11½	12	13	44	6½ × 5	6
Toungoo (largest) ad. ♂	71	40	11	13	13½	47½	8– × 5	6
,, Average of 4 ad. ♂	68	...	...	...	...	...	...	...
,, ,, ad. ♀	65	31	8	11	11	41	7 × 4	6
,, Average of 3 ad. ♀	64	...	...	...	...	...	...	...

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THE VERNAY SCIENTIFIC SURVEY OF THE EASTERN GHATS.

(Ornithological Section).

BY

Hugh Whistler, M.B.O.U., assisted by N. B. Kinnear, M.B.O.U.

Part XV.

(*Continued from page* 698 *of vol.* xxxviii).

Larus ichthyaëtus Pallas.

Larus ichthyaëtus Pallas, Reise Russ. Reichs, vol. ii (1773), p. 713—Caspian Sea.

No gulls were procured by the Survey. The Great Black-headed Gull is doubtless a winter visitor to the whole extent of the coastline of the Presidency, though it is as yet only recorded from three localities. William Davison obtained a female in full summer plumage on 20 March 1876 at Gopalpore on the Ganjam coast. This was made by Hume into the type of his *Larus innominatus* (*S.F.*, viii, 394) and the specimen is in the British Museum. Jerdon says that he saw it on the seacoast at Madras and one of his specimens is in the British Museum as well as two birds from the Hume collection obtained in the Madras roads in March.

On the Travancore coast Ferguson states that in February 1903 his collectors shot 5 specimens at Kayankolam Bar, though none had been seen there earlier in December.

Larus ridibundus ridibundus Linnaeus.

Larus ridibundus ridibundus Linnaeus, Syst. Nat., ed. xii, vol. i (1766), p. 225—England.

Jerdon says that he never met the Black-headed Gull in Southern India and Dewar in calling this the only gull that is common at Madras must surely have confused it with *Larus brunnicephalus*. Ferguson found it fairly common at Kayankolam Bar on the Travancore coast in January 1903. Two Travancore specimens collected by Bourdillon at Quilon on February 24th are in the British Museum.

Larus brunnicephalus Jerdon.

Larus brunnicephalus Jerdon, Madras Jour. Lit. Sci., vol. xii (1840), p. 225—West coast of India.

The Brown-headed Gull is evidently a common winter visitor to the coast of Madras and the fact that it is found about the coasts of Ceylon from October to March (Legge) suggests its probable dates for our area. Armstrong (*S.F.*, iv, 459) records that in the Madras roads at the end of March the majority were assuming breeding plumage, though only one was seen which had completed its moult.

As regards the west we have Hume's record (*S.F.*, iv, 456) that there were a very few about at Kolachel on 27 February 1876; Ferguson's record of numbers in attendance on some men fishing in a shallow lake near Cape Comorin in December 1903; and the adult male in the British Museum collected at Quilon in February 1880 (Hume collection). An adult from Cannanore (Haines) is in the Tweeddale collection.

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[Larus hemprichii Bruch.

Larus hemprichii Bruch, Journ. für Orn. (1853), p. 106—Red Sea.

Dewar states that a specimen of Hemprich's Gull labelled 'Madras' is in the Madras Government Museum. This locality is so far removed from the ordinary range of this gull, which has not been recorded nearer than Bombay, that it is difficult not to suspect a mistake and reserve the inclusion of Hemprich's Gull in the Presidency list.]

Larus sp.?

There is another large gull which is evidently a fairly common winter visitor to the coasts of the Presidency but at the moment it seems quite impossible to settle to what species it is to be attributed—for the taxonomy of this group is now in complete confusion owing to the latest researches on the subject, ending with Meinertzhagen's paper in the *Ibis*, 1935, p. 762—or to what subspecies, for the only two specimens in the British Museum [♂ 21-2-80 Travancore (Bourdillon) and ♀ 24-2-80 Quilon (Bourdillon)] are in immature plumage. A few adult feathers on the mantles of these specimens suggest to me that they belong to the Herring Gull type—*Larus cachinnans* of the *Old Fauna* (iv, 205)—which Armstrong (*S.F.*, iv, 459) under the name of *Larus leucophaeus* found in the Madras roads at the end of March, all more or less in immature plumage.

They were however labelled *Larus affinis* by Howard Saunders, who therefore considered them of the Lesser Black-backed Gull type, to which Ferguson attributed a specimen obtained by his collectors at Kayankolam in January 1903.

Chlidonias hybrida indica (Stephens).

Viralva indica Stephens, in Shaw's General Zoology, xiii, pt. i (1826), p. 169—Cawnpore.

Not obtained by the Survey. The Whiskered Tern is stated by Ferguson to be abundant in north Travancore, frequenting the coast, the backwaters and the paddy fields in the winter months.

The only other record that I find for the Presidency is afforded by the specimen in the Madras Museum collected at Tada in Nellore district.

There seems to be a good deal of confusion about the race of Whiskered Tern found in Ceylon. Stuart Baker (*New Fauna*, vol. vi, p. 113) says that birds from Ceylon are decidedly paler than Indian birds and he accepts with some hesitation *Ch. leucopareia leggei* Mathews, *Birds of Australia*, vol. ii (1913), p. 320—Ceylon as an island race. In *Nidification* (vol. iv, 361) he states that the Ceylon form, though darker than the Indian, cannot be separated from the Javan bird. I have carefully examined the series of 6 specimens from Ceylon in the British Museum and cannot separate them in any way from Indian birds and it is perhaps worth recalling the fact that neither Legge nor Wait have been able to ascertain that the Whiskered Tern breeds in Ceylon.

[Sterna leucoptera Temminck.

Sterna leucoptera Temminck, Man. d'Ornith., ed. i (1815), p. 483—Mediterranean Sea.

In the *New Fauna* (vi, 114) the White-winged Black Tern is said to migrate south to all western India and again to be common all down the east coast of India. The unwary might be led by this to expect to find the bird normally in the Presidency, so it may be as well to emphasise the fact that the *Old Fauna* (iv, 309) states that it has not been clearly identified from any part of India west of Tippera and I have seen no evidence to make me disagree with this statement.]

Hydroprocne caspia caspia (Pallas).

Sterna caspia Pallas, Nov. Comm. Acad. Sci. Petrop., vol. xiv (1770), p. 582—Caspian Sea.

Not procured by the Survey. The Caspian Tern no doubt occurs all round the coast of the Presidency but it is only recorded on the eastern side from

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Madras by Dewar. In Travancore Ferguson found it in fair numbers at Kayankolam Bar in January 1903, noting that it was generally seen in pairs. An adult from Mangalore is in the Hume collection.

The Caspian Tern breeds in Ceylon in small numbers and Wait remarks (ed. ii, p. 381) that specimens from Ceylon are slightly smaller and have shorter bills than the typical form. I have only been able to examine one Cinghalese specimen and this appears to agree with the typical race, as do the three Presidency specimens which I have examined.

Gelochelidon nilotica nilotica (Gmelin).

Sterna nilotica Gmelin, Syst. Nat., vol. i (1789), pt. 2, p. 606—Egypt.

Not obtained by the Survey. The Gull-billed Tern is a winter visitor to the Presidency. Dewar says that it is very common at Madras and Ferguson found it fairly common about the backwaters of North Travancore and also frequenting the coast at Manakolam Bar.

Thalasseus bergii velox (Cretzschmar).

Sterna velox Cretzschmar, Atlas Reise Nörd. Afr., vol. ii (1827), tab. xiii, p. 21—Red Sea.

The Large Crested Tern is a sea tern and therefore is confined to the seaboard of the Presidency, around the whole of which it is doubtless found at one time or another. It breeds on islets off the northern coasts of Ceylon. Jerdon says that it is found on the Malabar coast and, as regards the Travancore seaboard, Ferguson found numbers at Kayankolam Bar and further north in January and December 1903.

Dewar includes it in his Madras list and there are five specimens with no very precise data from Madras—here probably meaning the neighbourhood of Madras Harbour—in the British Museum. I cannot trace the locality Viziadrug from which there is a male dated 7 April 1879 in the Hume collection.

I do not think that *Thalasseus bergii edwardsii* Mathews, *Birds of Australia*, vol. ii (1912), p. 347—Ceylon can be upheld. Birds from Ceylon and the Red Sea can be separated neither in colour or in size:—

	Bill.	Wing.	Central tail.	Outer tail.
3 adult ♂ Ceylon	70.5-73.5	340-352	83-85.5	152-191 mm.
4 adult ♂ Red Sea and Aden	71-74	343-358	88-102	160-182 mm.

With these the few Presidency specimens entirely agree.

Thalasseus bengalensis (Lesson).

Sterna bengalensis Lesson, Traité d'Orn. (1831), p. 621—India.

Not procured by the Survey. The Smaller Crested Tern is another sea-going species which may probably be found all round the coasts of the Presidency as a visitor out of the breeding season. There is an immature male without data from Nursapatam in the Hume collection. It occurs commonly about the backwaters and coast of Madras harbour (Jerdon) and also of the Travancore coast (Ferguson), but no further details of its status in the Presidency appear to be on record. The three specimens from Quilon (Bourdillon) in the British Museum are dated November.

On the coast of Ceylon this Tern is the most numerous species and may be observed apparently throughout the year.

I have kept the name binomial as there appears to be a good deal of doubt as to the distinctness of the supposed Australian race.

Sterna aurantia Gray.

Sterna aurantia Gray, Illustr. Ind. Zool., vol. i (25 January 1831), pl. 69, fig. 2—India.

In the *New Fauna* (iv, 126) Mr. Stuart Baker says that the Indian River Tern is found on all large rivers throughout India. This may be so but the *Old Fauna* was more guarded and stated that it was less common in the south of the Peninsula.

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It is as well to emphasise, therefore, that I have found no definite record of this Tern in the Presidency, other than the specimen in the Madras Museum from Tada, Nellore district.

Sterna melanogaster Temminck.

Sterna melanogaster Temminck, Pl. Col., livr, 72 (1827), pl. 434—Island of Ceylon.

Specimen collected:—1196 ♂ 6-1-30 Godavery Delta.

Measurements:—

	Bill.	Wing.	Central tail.	Outer tail.	Tarsus.
1 ♂	41.5	226	67	144	18.5 mm.

In spite of Jerdon's statement that the Black-bellied Tern is common on every river in India we have not much information about its occurrence in the Presidency. The above specimen verifies La Personne's note that it was common on the Godavery in the Delta and Dewar includes its name without comment in his Madras list. Otherwise we have only Hume's remark (*S.F.*, x, 419) that he thought it occurred in the Wynaad, a suggestion as yet unverified. This handsome tern has no races.

[**Sterna hirundo** Linnaeus.

Sterna hirundo Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 137—Sweden.

Jerdon says that he obtained the Common Tern, on one occasion only, on the lake at Ootacamund and it is possible that the adult specimen from 'India' presented by Jerdon to the British Museum is really this specimen, though Hume discredited the record (*S.F.*, x, 418). Ferguson states that it is an occasional winter visitor to the coast of South Travancore, though he had not met with it at all in the north. His few specimens, he goes on to say, are immature. It does not appear that these specimens were ever examined and compared critically and I do not think therefore that this species should yet be definitely included in the Presidency list.]

Sterna repressa Hartert.

Sterna repressa Hartert, Nov. Zool., vol. xxiii (1916), p. 288—Persian Gulf.

Not procured by the Survey. Practically nothing is known about the status of the White-cheeked Tern on the Presidency coast. A female obtained on May 5th at Viziadroog, Malabar Coast—a locality which I cannot precisely identify—is in the Hume collection and the Madras Museum contains a specimen said to have been collected at Ennur in Chingleput.

I can find no authority for the statement in the *New Fauna* (vi, 128) that this Tern occurs in Ceylon, though it may well do so on occasion.

[**Sterna dougalli korustes** Hume.

Sterna korustes Hume, Stray Feathers, vol. ii (1874), p. 318—Andaman Islands.

Messrs. Inglis and Baker include this Tern in the *Birds of Southern India* on the grounds that it breeds in Ceylon and is sometimes seen off that coast in some numbers. This fact is true but there is as yet no actual record that would justify the inclusion of the Roseate Tern in the Presidency list.]

Sterna albifrons Vroeg.

Sterna albifrons Vroeg, Cat. d'Ois., Adumb. (1764), p. 6—Holland.

I have seen no specimens of the Little Tern from the Presidency and so cannot say anything about the subspecies which occurs there. According to Jerdon, the Little Tern is most abundant at the mouths of tidal rivers and backwaters on the Malabar coast and is more rare apparently on the east coast. Ferguson, however, can only mention a single specimen shot on the coast of North Travancore in January 1903, and Dewar includes the species without comment in his Madras list. Mr. H. L. Smith kindly informs me that he took two clutches of fresh eggs on a sand-bank at Masulipatam in April 1918 and found the species then fairly common.

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Sterna anaetheta antarctica Lesson.

Sterna antarctica Lesson, Traité d'Orn. (1831), p. 621—Isle of France.

There are three specimens of the Brown-winged Tern in the British Museum which may be included in the Presidency list. These are an adult female in summer plumage taken at sea on 7 May 1876 sixty miles north of Madras (William Davison) and a male and female which 'fell on board off Cape Comorin 77°E. Lat. 8°N' on 26 September 1874 (Hume collection). These birds measure bill ♂ 48 ♀♀ 42, 44.5, wing ♂ 242 ♀♀ 245, 250 and in my opinion belong to the above race, though for lack of material I have not been able to revise the races of this Tern.

Rhynchops albicollis Swainson.

Rhynchops albicollis Swainson, Anim. in Menag. (1838), p. 360—India.

Not procured by the Survey. There is only one locality known to me for the Indian Skimmer in the Presidency. Colonel Sparrow informs me that he found it breeding at Bezwada in 1913 and the earliest date on which he saw young on the wing was 21 March.

Arenaria interpres interpres (Linnaeus).

Tringa interpres Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 148—Sweden.

The Turnstone is evidently a fairly common winter visitor to the shores of the Presidency. Mr. H. C. Smith informs me that he procured it at Masulipatam. Jerdon says that he procured it not uncommonly on the sea-coast near Madras and he doubtless provided the 'Madras' specimen which is in the Gould collection in the British Museum. Hume records it from Rameswaram Island in March (Hume, *S.F.*, iv, 459) and Cardew met with it on the Malabar coast (Baker & Inglis, p. 377).

Squatarola squatarola squatarola (Linnaeus).

Tringa squatarola Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 149—Sweden.

Jerdon says that he obtained the Grey Plover from the Madras market and there is an undated specimen (Wardlaw-Ramsay) and a male in remains of breeding plumage dated 1st September 1866 (Hume collection) from Madras in the British Museum.

For the western side Major Phythian-Adams informs me that he shot 7 from a flock of 25 Grey Plover in January 1933 at a place 14 miles north of Cannanore. This is the only occasion on which he has met with the species in South India.

Leucopolius alexandrinus alexandrinus (Linnaeus).

Charadrius alexandrinus Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 150—Egypt.

Specimens collected:—1208 ♀ 1216 ♂ 9-1-30 Godaveri Delta.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
1 ♂	18.5	110	47	29 mm.
1 ♀	19	110	47	26.5 mm.

In addition to the above two specimens collected by the Survey on the Godaveri Delta, Cardew is said to have met with the Kentish Plover at Bezwada (*Birds of S. India*, p. 379) and Dewar includes it in his Madras list without comment.

On the western side of the Presidency Ferguson states that it was fairly numerous at Neendakaray in Travancore in January.

The above two specimens undoubtedly belong to the typical race, but I may here remark that it is impossible to consider the birds which breed so numerously in Ceylon as the same subspecies. Seebohm pointed out years ago that Ceylon birds are very small—I measure: 3 ♂ bill 18-19.5, wing 103-104, tail 43-44, tarsus 25-27 mm.; 3 ♀ bill 17-20, wing 96.5-104, tail 39-43, tarsus 25-28.5 mm.—and proposed that they should be included with birds from the southern shores of the Red Sea under the name *Charadrius*

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cantianus minutus Seebohm, Geogr. Distrib. Charad. (1887), p. 169. This name was however preoccupied and Hartert and Jackson, *Ibis* 1915, p. 529 bestowed the name *Charadrius alexandrinus seebohmi*. Their restricted type locality Aripo, N. Ceylon cannot be accepted, as the correct type locality for *minutus* was Zulla and the name must therefore become a synonym of the typical race as recently pointed out by Captain C. H. B. Grant.[1] All three authors however overlooked what appears to be the most important difference of the Ceylon race that it does not acquire the chestnut cap of the breeding plumage of the typical race. This absence of a distinctive breeding plumage is a characteristic of other Cinghalese races and is of great interest. I therefore propose to mark it with the name

LEUCOPOLIUS ALEXANDRINUS LEGGEI subsp. nov.

Type:—♂ 27 June 1873, Hambantotta, S.-E. Coast, Coll. W. V. Legge, British Museum Register No. 96-7-1-545.

Differs from the typical race in its smaller size and in the fact that it does not assume the distinctive breeding plumage.

Haematopus ostralegus Linnaeus.

Haematopus ostralegus Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 152—Oeland Island, Sweden.

Jerdon said that he had heard of the Oyster-catcher being procured at Mangalore and he considered it was far from rare near Tellicherry, thereby no doubt implying much the same status as on the Travancore coast where Ferguson calls it a more or less rare winter visitor, occurring generally in small flocks of half a dozen or so. It also occurs on the eastern coast of the Presidency as Dewar includes it in his Madras list and there is a local specimen in the Government Museum. I have seen no specimen and so cannot identify what race occurs in our area.

Elseyornis melanops (Vieillot).

Charadrius melanops Vieillot, Nouv. Dict. Hist. Nat., xxvii (1818), p. 139—Terres Australes.

In the *Madras Journ. Lit. Sci.*, vol. xxix (October 1840), p. 213, Jerdon described an apparently new species of Ring Plover under the name of *Charadrius russatus* and stated definitely that he procured it himself at the edge of the Pulicat Lake near Madras. The actual specimen is not at present traced but the description is full and clear and Jerdon particularly remarks on the maroon colour of the scapulars as a distinguishing feature. The species was not however new, having been described by Vieillot in 1818 and Jerdon's name was relegated to the synonym of this Australian bird. Its occurrence in Madras must however be accepted and the Australian Black-fronted Plover should be brought on to the Indian list though the record has been overlooked in both editions of the *Fauna*.

Charadrius dubius curonicus Gmelin.

Charadrius curonicus Gmelin, Syst. Nat., vol. i (1789), p. 692—Curonia = Courland, Latvia.

This western and northern race of the Little Ring-Plover is undoubtedly a winter visitor to the Presidency as I must attribute to it two immature and unsexed specimens (wings 119.5 and 121 mm.) from Coorg in the Tweeddale collection and also two unsexed adults from 'Madras' (wings 115 and 119.5 mm.) in the British Museum. The specimens collected by the Travancore survey also show that this form occurs in Travancore where Ferguson writes that he does not think the bird is a resident but that it comes very early to the coast. He had seen stragglers at Cape Comorin early in August and flocks might be seen as late as April. They are abundant in the dry rice fields after harvest and about the shores of tanks and beds of streams in the low country.

Major Phythian-Adams informs me that a flock of Little Ring-Plovers haunts the maidan near the Fort at Cannanore every cold weather and Hume

[1] Bull. B.O.C., vol. lvii, p. 44, November 1906.

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(*S.F.*, x, 412) said that he had records from Sultan's Battery, Wynaad and near the foot of the Coonoor Ghat. Jerdon says that he procured it from the top of the Eastern Ghats inland from Nellore. There is however no evidence regarding the race of these birds.

Charadrius dubius jerdoni (Legge).

Ægialitis jerdoni Legge, P.Z.S. 1880 (June 1st), p. 39—Ceylon.

Specimens collected:—1071 ♀ imm. 9-12-29 Cumbum Valley; 1209 ♀ 9-1-30, 1235 ♂ 12-1-30 Godavery Delta.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
1 ♂ adult	15.5	109	57	23.5 mm.
1 ♀ adult	15.5	105.5	58	23 mm.
1 ♀ imm.	15.5	113	57.5	23 mm.

The above specimens collected by the Survey I attribute from their measurements to the resident race of Little Ring-Plover and to it presumably also belong the nests found by Colonel R. Sparrow with c/3 fresh eggs each at Bezwada on 20 March 1913 and 14 February 1914 and with c/3 eggs ready to hatch on 8 April 1913. At the same time I should like to point out that I have been unable to examine a series of breeding birds from Ceylon or India sufficient to establish the validity of this race. The only specimen examined from Ceylon (♂ imm.) has a wing of 118 mm.

Charadrius mongolus atrifrons Wagler.

Charadrius atrifrons Wagler, Isis (1829), col. 650—Bengal.

Jerdon states that he procured the Lesser Sand Plover in the Carnatic, at Madras and on the Malabar coast, and Ferguson in remarking that it is a winter visitor to the Travancore coast adds that it is sometimes found inland, a specimen being actually procured on the High Range at 6,000 ft. There are two 'Madras' specimens in the British Museum. I have no information about the dates of arrival and departure of this winter visitor but Mr. Van der Sleem collected a female on 7 September 1926 west of Parasala, Travancore, which is now in Mr. A. E. Jones' collection.

Charadrius leschenaultii Lesson.

Charadrius leschenaultii Lesson in Levrault's Dict. Sci. Nat., vol. xliii (1826), p. 36—Pondicherry.

The Greater Sand Plover is evidently less common than the lesser species on the Presidency coasts, though it is probably also a regular winter visitor. Jerdon states that he procured it on the east coast at Madras and Ferguson says that a single specimen was shot at Neendakaray near Quilon.

Pluvialis dominica fulva (Gmelin).

Charadrius fulvus Gmelin, Syst. Nat., vol. i, pt. ii (1789), p. 687—Tahiti.

The Eastern Golden Plover is a fairly common winter visitor to the Presidency and it seems to be generally distributed in suitable localities. Major E. G. Phythian-Adams and Mr. R. F. Stoney have been kind enough to send me extracts from their shooting diaries and from these it is evident that the bird is far more common on the western side of the Presidency than on the east.

For the eastern side, I find that Mr. Stoney has killed a total of 97 Golden Plover (mostly in the Kistna, Chingleput and Madura districts) for the years 1899-1931. His two largest bags in a single day were 10 and 11 birds. While on the west, shooting only at Cannanore and that for strictly limited periods between 1925 and 1930, Major Phythian-Adams has a total of 180 Golden Plover, his biggest totals for a season being 22 (season 1929-1930), 40 (season 1931-1932), 47 (season 1932-1933) and 32 (season 1934-1935).

At the Chilka Lake, Annandale says that this species arrives about the middle of September and does not depart until May. Mr. Stoney's earliest

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date for Kistna district is 29 September (1905) and Major Phythian-Adams' for Cannanore is 21 September (1929), while Mr. H. C. Smith informs me that he met with the bird at Masulipatam on 16 April 1918. A specimen in the Hume collection from Naraman, Madras, is dated 25 August 1866. The breeding plumage is assumed before the bird leaves South India and this fact, together with the late date on which the last stragglers may be found, misled Jerdon into the assumption that the Golden Plover bred at Nellore. Hume records it at Rameswaram Island in March (*S.F.*, iv, 459).

On the west coast, the Golden Plover is, as indicated above, numerous at Cannanore. Further south Ferguson says that flocks may be commonly met in North and Central Travancore, about Cherayankie, Parur and Vycomb frequenting swampy flats and paddy fields.

No specimens were procured by the Survey.

Chettusia gregaria (Pallas).

Charadrius gregarius Pallas, Reise Russ. Reichs, vol. i (1771), p. 456—Volga.

There is only one record of the Sociable Plover in the Presidency as its normal winter range does not extend so far south. Ferguson records how he shot two birds from a flock of five that were feeding in some paddy fields at Trivandrum in January 1900. Their appearance was no doubt due to the failure of the rains in Northern India in 1899 which resulted in a famine.

Lobivanellus indicus indicus (Boddaert).

Tringa indica Boddaert, Table Pl. Enlum. (1783), p. 50 on Pl. Enl. 807—Goa, India.

Specimens collected:—92 ♀ 19-4-29 Kurumbapatti; 1245 o? 13-1-30 Godavery Delta.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
1 ♀	33	208	108	70 mm.
1 sex?	36.5	213	111	74 mm.

The Red-wattled Lapwing seems to be found more or less generally throughout the Presidency but I do not find any actual record from north of the Godavery Delta. There are specimens from Annappukolam, Nellore district, in the Madras Museum and Dewar calls this bird very common at Madras. The Survey also found them at Kurumbapatti and, rather more commonly, about Salem town.

On the west, Ferguson says that the Red-wattled Lapwing is common in the low country all over Travancore and Terry heard it calling at night at Pittur in the Palnis. Further north Betts calls it common in Coorg and Davison says that it is not uncommon in the Wynaad. From here it ascends the Nilgiris in small numbers, a few pairs even breeding on the plateau. In Southern India this plover is strictly resident and Betts remarks to me that each pair may be found inhabiting the same stretch of country for years together.

The breeding season in the Nilgiris is said to be in April and May (Miss Cockburn) and Ferguson gives it as March in Travancore.

I do not myself see much use in maintaining the race *aigneri* for this species. After examining a large number of birds from Ceylon to Afghanistan and Mesopotamia I find that though there is a slight average increase in size from Ceylon to the north-west, accompanied by a very slight paling of colour, it is accompanied by so much individual variation that it is quite impossible to define any recognisable limits for two races *indicus* and *aigneri*. Ticehurst was inclined to maintain the two races on the amount of gloss (*Ibis* 1923, p. 665) but this does not seem to me a good character either.

Lobipluvia malabarica (Boddaert).

Charadrius malabaricus Boddaert, Tabl. Pl. Enlum. (1783), p. 53 for Pl. Enl., 880—Malabar.

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Specimens collected:—455 ♀ 21-6-29 Tirthamalai 1,000 ft.; 660 sex? 6-8-29 Palkonda Hills 1,000 ft.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
1 ♀	27.5	190.5	70.5	56.5 mm.
1 sex?	29	193	76	59 mm.

There appears to be no actual record of the Yellow-wattled Lapwing in the Presidency from anywhere north of the Palkonda Hills where it was procured by the Survey. Dewar says that it is very common about Madras and the Survey also obtained it at Tirthamalai.

In Travancore, it is common (Ferguson, Stewart). From further north on this side I have seen specimens from Malappuram (Sparrow coll.: ♂ 7-6-1912), from the neighbourhood of Segore (Sigur ♀ 22-2-81, William Davison) and Sultan's Battery, Wynaad (♀ 31-1-83, William Davison).

In Travancore, Bourdillon found them breeding from 3 March to 13 August and Stewart from 4 April to 6 August (Stuart Baker, *Nidification*, iv, 402). Under this reference and in our *Journal*, xxxv, p. 250, Mr. Stuart Baker has a good deal to say about an erythristic type of egg found on an outcrop of red laterite soil in Travancore.

I have only seen one specimen, and that a juvenile, of the Yellow-wattled Plover from Ceylon. On the mainland there is perhaps a slight increase in size from south to north, and birds from Travancore appear slightly richer in colour than those of the Peninsula generally. The material available from the south is not however very good and at present I am not satisfied that the recognition of any races is justified.

[**Recurvirostra avosetta** Linnaeus.

Recurvirostra avosetta Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 151—South Europe.

Dewar includes the Avocet in his Madras list without any comment but I have seen no evidence that it has ever been found in the Presidency, beyond Jerdon's statement (*Madras Jour. Lit. Sci.* 1840, p. 209, that he had seen stuffed specimens killed as far south as Madras. Further evidence is required before the avocet can be admitted to the Presidency list.]

Himantopus himantopus (Linnaeus).

Charadrius himantopus Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 151—Southern Europe.

There is a local specimen of the Black-winged Stilt in the Madras Museum and this is doubtless Dewar's warrant for the inclusion of the species in his list. I know of no other record for the Presidency.

Numenius arquata (Linnaeus).

Scolopax arquata Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 145—Sweden, Europe.

The Curlew is doubtless found around the whole coast of the Presidency as a winter visitor. In Travancore, Ferguson says that it is found only on the coast, but not in any great numbers. At Madras, Dewar says that it occurs in considerable numbers in all places where there is shallow salt water. I have seen no specimen from the Presidency but the race that occurs will prove no doubt to be *N. a. orientalis* Brehm.

Numenius phaeopus phaeopus (Linnaeus).

Scolopax phaeopus Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 146—Sweden.

Jerdon says (*Madras Jour. Lit. Sci.* 1840, p. 212) that he saw the Whimbrel in considerable numbers at the Chilka Lake and that he had also seen it on the seacoast near Madras. There is a Madras specimen in the Hume collection dated 1 September 1866. Hume records it from Rameswaram Island in March (*S.F.*, iv, 459).

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On the western side Colonel H. R. Baker (*Birds of S. India*, p. 392) says that it is one of the earliest winter visitors to arrive. He first noticed their arrival near Cannanore on 5 August 1910 and shot a couple on the 25th of that month.

In Travancore Ferguson says that it may be found in suitable places along the coast in fair numbers from October to April.

[**Limosa limosa** (Linnaeus).

Scolopax limosa Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 147—Sweden.

The Black-tailed Godwit is included by Dewar in his list without comment. This species is however so very rare in Central and Southern India that it cannot be included in the Presidency list until a more positive record is forthcoming.]

Limnodromus semipalmatus (Blyth).

Macrorhamphus semipalmatus Blyth, J.A.S.B., vol. xvii (1848), p. 251—Madras.

The claim of the Snipe-billed Godwit to a place on the Presidency list is based solely on the specimen which Jerdon procured in the Madras market about the close of 1844 and which was the type of the species.

Terekia cinerea (Güldenstadt).

Scolopax cinerea Güldenstadt, Nov. Comm. Acad. Sci. Imp. Petrop., vol. xix (1774), p. 473, pl. 19—Terek River.

The Terek Sandpiper is included in his list by Dewar without any comment, but Major Phythian-Adams kindly informs me that he shot two from a flock at Cannanore on 12 December 1931. Jerdon says (*Madras Jour. Lit. Sci.*, 1840, p. 208) that he only met with it on one occasion, at the edge of the Trichoor Lake.

Tringa ochropus (Linnaeus).

Tringa ocrophus (sic) Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 149—Sweden.

Specimens collected:—807 ♂ 11-9-29 Kodur; 1085 ♀ 11-12-29, 1136 ♀ 18-12-29 Cumbum Valley.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
1 ♂	37.5	130	53	33.5 mm.
2 ♀	39-40	143-149	61-63	33-35 mm.

The Green Sandpiper is of course a winter visitor to the Presidency but it is there far less common than in Northern India. On the eastern side, the only record that I have traced, in addition to the three Survey specimens, is a specimen from Chingleput in the Madras Museum. In Coorg, according to Betts, it is not uncommon, arriving fairly early (first seen on September 30, 1928) and staying late, often lingering well on into May. There are two specimens from the Nilgiris in the British Museum, shot in April by William Davison, but these must have been collected after his paper in *Stray Feathers* in which he states that a specimen shot some years previously on the bank of the lake at Ootacamund was the only one that he had seen in Southern India.

Terry says that he shot one on May 4th in the Pittur Valley but a specimen collected by Terry in the Palnis and now in the British Museum is dated April 3rd. In Travancore Ferguson considered it as not nearly so common as *T. glareola* and he mentions one shot in a swamp on the High Range at 6,000 ft. in January.

Tringa stagnatilis (Bechstein).

Totanus stagnatilis Bechstein, Orn. Taschenb., vol. ii (1803), p. 292—Germany.

There is a specimen of the Marsh Sandpiper from Calicut in the Tweeddale

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collection in the British Museum and Jerdon states that he saw it in large flocks on the banks of the Trichoor Lake. Further south in Travancore Ferguson's collectors met with flocks on the seashore at Manakodam Bar and at North Parur. They were in company with Greenshanks.

On the eastern side Dewar includes the species in his Madras list, doubtless on the evidence of the local specimen in the Madras Museum. Another Madras specimen dated December 11th is in the Tweeddale collection. The bird is of course a winter visitor to the Presidency.

Tringa hypoleucos Linnaeus.

Tringa hypoleucos Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 149—Sweden.

Specimen collected:—806 ♀ 11-9-29 Kodur.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
1 ♀	26	111	57.5	24 mm.

The Common Sandpiper is no doubt common and very generally distributed throughout the Presidency, though on the eastern side, we have no other information beyond the Survey specimen and Dewar's statement that it is very abundant about Madras. His belief that it is a resident is of course incorrect. The Common Sandpiper is a winter visitor to India south of the Himalayas but a certain number of non-breeding individuals may be met throughout the summer months in their winter quarters.

In Travancore Ferguson calls it one of the most widely spread of birds, common in the paddy fields everywhere from September to May. William Davison also considered it common in the Nilgiris. There is a specimen from Mangalore (24 April, Dr. Day) in the Hume collection.

Tringa glareola Linnaeus.

Tringa glareola Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 149—Sweden.

Specimen collected:—1135 ♀ 18-12-29 Cumbum Valley.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
1 ♀	31.5	124	47	35 mm.

The Wood Sandpiper is a common winter visitor and passage migrant on its way to Ceylon in the western side of the Presidency. William Davison says that in the Nilgiris he has seen specimens about the ponds in the Botanical Gardens at Ootacamund as late as July, though these, I suggest, may have been non-breeding birds which had not migrated to their summer quarters. In Travancore Ferguson considered it the commonest of the Sandpipers, to be found in abundance in the wet paddy fields from August to May.

On the eastern side we have no particular information about it, the Survey specimen and Dewar's inclusion of it in his Madras list being the only published records.

Tringa totanus (Linnaeus).

Scolopax totanus Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 145—Sweden.

The Common Redshank has been very seldom recorded in the Presidency where it is, of course, a winter visitor. Major Pythian-Adams informs me that it is not uncommon about Cannanore. Ferguson's collectors secured one at Neendakaray in January 1903. There is a local specimen in the Madras Museum and Mr. H. C. Smith informs me that he shot one at Masulipatam on 16 April 1918. No specimen has been critically examined for racial identification.

Tringa erythropus (Vroeg).

Scolopax erythropus Vroeg, Cat. d'Ois, Adumb. (1764), p. 6—Holland.

The Spotted Redshank must occur in the Presidency as the British Museum possesses a 'Madras' skin from Jerdon and another from Chingleput in the

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Hume collection. Both are in breeding plumage. I can find no other information regarding it in our area.

Tringa nebularia (Gunnerus).

Scolopax nebularia Gunnerus in Leem's Beskr. Finmark. Lapp. (1767), p. 251, note—Norway.

Major Phythian-Adams informs me that the Greenshank is not uncommon round Cannanore in the cold weather. Hume stated (*S.F.*, x, 414) that he had received it from the Wynaad. Kinloch saw a solitary bird by the Manalora stream in the Nelliampathies. Ferguson says that he had never met with the Greenshank in Southern Travancore but that in the north his collectors met with flocks and obtained specimens at Yettamanna, Shertally and Vycombe. There is, however, a male collected by Bourdillon at Quilon on February 25 in the British Museum.

On the eastern side it is recorded only from Madras, in Dewar's list.

Philomachus pugnax (Linnaeus).

Tringa pugnax Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 148—Sweden.

The Ruff and Reeve have so far only been recorded in the Presidency from the neighbourhood of Madras. In the British Museum there is a female in the Tweeddale collection collected at Madras by Wardlaw-Ramsay on December 2nd. The Madras Museum contains specimens collected at Madras and at Vandalur, Chingleput district. It is of course a winter visitor.

Crocethia alba (Vroeg).

Tringa alba Vroeg, Cat. d'Ois. Adumb. (1764), p. 7—Coast of North Sea, Holland.

Jerdon states (*B. of I.*, iii, p. 694) that he obtained the Sanderling on the coast at Nellore where it appeared to be tolerably abundant. There is a local speicmen in the Madras Museum. It must of course be a winter visitor.

Erolia minuta minuta (Leisler).

Tringa minuta Leisler, Nach. zu Bechst. Nat. Deutsch. (1812), p. 34—Germany.

Specimen collected:—1210 ♀ 9-1-30 Godavery Delta.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
1 ♀	22	101	42	22.5 mm.

The Little Stint is a winter visitor to the Presidency and before the Survey obtained the above specimen it had already been recorded on the eastern side by Dewar in his Madras list. On the west Hume says (*S.F.*, x, 414) that he had himself seen it below the Coonoor Ghat and Ferguson recorded it as a fairly common winter visitor to the coast of North Travancore.

Erolia temminckii (Leisler).

Tringa temminckii Leisler, Nacht. zu Bechst. Nat. Deutsch. (1812), p. 63—Germany.

Specimen collected:—1234 ♂ 12-1-30 Godavery Delta.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
1 ♂	17.5	95	48	16.5 mm.

The above Survey specimen appears to provide the first explicit record of Temminck's Stint for the Presidency, with the exception of Dewar's inclusion of the species in his Madras list without comment.

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Erolia testacea (Pallas).

Scolopax testacea Pallas in Vroeg's Cat. d'Ois. Adum. (1764), p. 6—Holland.

According to Ferguson, the Curlew-Sandpiper is found from October to April on the coast of North Travancore, especially by Manakodam Bar. It is apparently also fairly common on the eastern coast as Mr. H. A. Smith informs me that he shot one at Masulipatam on 16 April 1918, Dewar includes it in his Madras list, there is a local specimen in the Madras Museum and a pair of adults collected by Wardlaw-Ramsay at Madras in December are in the Tweeddale collection in the British Museum.

[**Calidris tenuirostris** (Horsfield).

Totanus tenuirostris Horsfield, Trans. Linn. Soc., vol. xiii, (May 1821), p. 192—Java.

Dewar's inclusion of the Eastern Knot in his Madras list is probably based on Jerdon's record of obtaining a Knot *Tringa canutus* at Madras (*B. of I.*, iii, 689), a record which is usually considered to refer to this species.]

Limicola falcinella (Pontoppidan).

Scolopax falcinellus Pontoppidan, Danske Atlas, vol. i (1763), p. 623—Denmark.

Very little is known about the occurrence of the Broad-billed Sandpiper in the Presidency but Ferguson states that a single specimen was shot by his collectors at Manakodam Bar in Travancore in January 1903. Three unsexed specimens, two in winter plumage and one in worn breeding dress, labelled 'Madras' are in the British Museum. One of these is dated April 1876.

Lobipes lobatus (Linnaeus).

Tringa lobata Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 148—Hudson Bay, America.

The Red-necked Phalarope is said in the *Old Fauna* (iv, 282) to occur on the west coast of India and on the east coast as far north as Madras where, at times, it is not uncommon. I have not found the source of this statement but Jerdon said he had a single record for India, namely a bird obtained by Dr. Stewart at Madras (*B. of I.*, iii, 696) and the British Museum possesses three specimens from 'Madras' dated September-October in the Hume collection. There is also a local specimen in the Madras Museum.

Scolopax rusticola Linnaeus.

Scolopax rusticola Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 146—Sweden.

The Woodcock was not obtained by the Survey but it is well known as a winter visitor to the hills of the Presidency and more particular to the western side, where it is naturally best known as a sporting bird in the Nilgiris.

On the west Jerdon says that it is found in Coorg and A. G. Theobald records (*apud* Hume & Marshall, iii, 311) that he has heard of their being shot in the Wynaad.

Regarding the Nilgiris there is a good deal on record. For these hills Captain Lambton (*J.B.N.H.S.*, xx, 854) on the authority of the Hadfields *père et fils* gives the season as follows:—Woodcock invariably arrive on the Nilgiris during the month of October and never has this month gone by without a bird being bagged. The 9th October is the earliest date on which the first bird was seen and killed but the third week in October is generally the earliest that the first cock is accounted for. The October flight is as a rule very small and the birds that put in an appearance can be numbered on the fingers of one hand.

December and January are the months when cock drop in larger numbers and by the end of March there is not a bird to come across.

William Davison (*apud* Hume & Marshall, iii, 310) would perhaps consider the season a little shorter. They come in late in October, or early in November, he says, and depart again at the latest by the end of February. Col. Baker (*J.B.N.H.S.*, xxix, 564) puts their arrival in the first week of November and Major Phythian-Adams (*J.B.N.H.S.*, xxxii, 607) considers February the

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best month for Woodcock and adds that nearly all are gone by March 15th or earlier if heavy rain falls. Major Logan Home (*J.B.N.H.S.*, xxix, 841) mentions an exceptionally late bird flushed on the Krurmand Mukerti Peak track on 28 April 1923. The male dated 25 May Ootacamund (W. Davison) in the Hume collection was doubtless a pricked bird.

As regards the number of Woodcock that visit the Nilgiris the general and I fear correct idea is that they are decreasing. Captain Lambton was informed that in the early 'sixties' of the last century a single gun was known to have bagged 250 cock during one season. This, if not exaggerated, was surely an exceptional case and not to be compared with the 30 or 40 birds which Capt. Lambton considered a good season's bag about 1910. He goes on to say that the largest bag made by two guns within the last 35 years in one day was 7 couple, all the birds flushed being accounted for, while 3 or 4 Woodcock are the normal number to be obtained in a day's shooting. These figures should be compared with Jerdon's statement, made as a matter of course and no doubt representing the normal sport of the 'fifties and sixties' that he had himself killed 8 in a forenoon and had known 16 and 20 killed by two or three guns.

In 1921 Colonel H. R. Baker writes (*loc. cit.*):—'Now a single gun is lucky, as I have been, if he gets 30-40 cock in a season and 6 in a day. In 1920-21 I got 35 and in 1921-22 I got 29 and in both seasons my best bag was 6 in a day out of 7 seen.'

In 1927 (*J.B.N.H.S.*, xxxii, 607) Major Phythian-Adams considers 25-30 Woodcock a good average season's bag, it being remembered that small game shooting on the plateau is now limited to two days a week. He has kindly given me the figures for his own shooting for the seasons from 1923 to 1930 and the number per season varies from 12 to 27.

A note on weights will be found in our *Journal* in vol. xx, 1154, and a good account of a typical day's shooting by Col. H. R. Baker will be found in vol. xxviii, 434-38.

Leaving the Nilgiris, Theobald says that he has shot Woodcock in the Anamallais and in the Burghoor and Husinoor Hills of the Coimbatore district. Fairbank says that they are certainly rare in the Palni Hills but that he himself flushed one in the Kodaikanal in 1867 and that afterwards one was shot by a Mr. Levinge.

In the Nelliampathies, Kinloch says it is very rare but I cannot make out whether his idea that it dropped in on passage at the end of September and beginning of October and again early in March is theory or based on observation. It seems at variance with what we know of the bird in the rest of the area.

In Travancore, according to Ferguson, occasional Woodcock may be met in grass land bordered by forest in South Travancore at about 4,000 ft. in the winter. On the High Range, he adds, it used to be fairly common at this period in similar localities, before the forest was cut down for coffee and tea. Bourdillon considered it pretty common in the Assambo Hills, but only at the highest elevations from November to March.

On the eastern side of the Presidency there is far less information. Ball states (*S.F.*, v, 419) that he was assured by a Mr. Blaxland that Woodcock had been several times seen and on one occasion shot on the higher plateaux of Jeypore. One was shot by Mr. L. T. Harris, I.C.S., at Salabam 4,000 ft. on 26 February 1915 (*J.B.N.H.S.*, xxiii, 777). Jerdon says that he knew of it having been procured at Masulipatam and at least once found in the Madras market.

There is a specimen from the Shevaroys in the Madras Museum and, finally, Theobald informs us that he had shot Woodcock on the Shevaroys and Javadi Hills of the Salem district.

Capella nemoricola (Hodgson).

Gallinago nemoricola Hodgson, P.Z.S. 1836 (April 9), p. 8—Nepal.

The Wood Snipe was recorded by Colonel McMaster at Russelconda in Gumsoor (Hume & Marshall, iii, 326) where he obtained two. It has not been otherwise recorded on the eastern side of the Presidency north of the Shevaroy Hills where it was shot by Albert Theobald (Hume & Marshall, iii, 326) and H. R. P. Carter on December 28 (specimen in British Museum).

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On the western side, it is of course far better known. It is usually met with in the hills but Major E. G. Phythian-Adams shot one about 12 miles north of Cannanore on 27 November 1933 (*J.B.N.H.S.*, xxxvii, 220). It is found in Coorg (Hume & Marshall, iii, 326) and in the Wynaad where J. W. Ditmas records (*S.F.*, x, 173) that he saw 7 Woodsnipe in 18 years' residence and bagged three of them. Phythian-Adams considers that the bird is probably commoner in the Wynaad than in the Nilgiris (*J.B.N.H.S.*, xxxii, 606).

'On the Nilgiris', says William Davison (*S.F.*, x, 413), 'it was never common and seems to be getting still more rare, year by year, and though when on the Nilgiris last I had offered all the native shikaris a large price for any specimens they could procure me, I failed to get any'. I doubt, however, whether Davison is correct in thinking the bird any rarer than it always has been. Colonel H. R. Baker shot 5 in February and March 1922 (*J.B.N.H.S.*, xxix, 564) of which 2 males are now in my collection. Major Phythian-Adams has kindly given me details of 6 birds shot by him, viz.:— one on 2 January 1924, two on 29 January 1927, and one on each date 2 January 1928, 16 February and 29 October 1929. Mr. R. F. Stoney has also been good enough to tell me that he shot single birds on 3 December 1933 and 15 February 1935.

Albert Theobald (*loc. cit.*) shot the Woodsnipe in the Guddasal Hills of the Coimbatore district, in the Annamalais and in the Palnis. In Travancore its occurrence rests on a single bird shot in the High Range and in the Trivandrum Museum when Ferguson wrote (*J.B.N.H.S.*, xvi, 10).

I have little doubt that the Woodsnipe is merely a winter visitor to the Presidency and it has been recorded every month from 29 October to the 6th March.

Capella solitaria (Hodgson).

Gallinago solitaria Hodgson, Glean. Sci., vol. iii (August 1831), p. 238—Nepal Terai.

The solitary Snipe may perhaps just come into the Presidency list in virtue of its occurrence on the Chilka Lake. Mr. H. B. Tilden killed one at Nalban Island on 16 December 1921. It was identified by Mr. T. McDonnell of Calcutta who informed him that several had been flushed in the same locality by Mr. James Smythe of Calcutta at Christmas 1920 (*J.B.N.H.S.*, xxviii, 1133).

This record may be correct but I feel by no means satisfied with the identity of the specimen said to have been shot near Davala, S.-E. Wynaad, in 1898 by Mr. F. W. F. Fletcher and Mr. W. Hamilton (Stuart Baker, *Game Birds*, ii, 39).

Capella gallinago gallinago (Linnaeus).

Scolopax gallinago Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 147—Sweden.

In the Madras Presidency, the Fantail Snipe is definitely less numerous than the Pintail and it is not quite so generally distributed. Unfortunately the recorded evidence is not sufficient to enable me to write a very satisfactory account of the species.

In the north-east of our area, there is not apparently a very great disproportion between the numbers of the two species. In fact, about the Chilka Lake and Ganjam, it is possible that the Fantail is actually the more numerous. But as one works southwards the Pintail is found to be more and more numerous compared with the Fantail and this is also the case along the western side of the Presidency, as shown by the comparative totals cited in the account of the Pintail. In the Nilgiris, or at least at higher elevations, the Fantail does not normally occur, and I have no record of it at all for the Travancore Hills or Eastern Ghats. Terry and Fairbank both, however, record it in the Palnis, though the elevation is not given. In Ceylon it is of course a rare straggler.

The times of arrival and departure are, for lack of exact evidence, hard to define. In any case they evidently vary a good deal from year to year, being no doubt largely dependent on existing conditions in the more northern portions of the bird's range, particularly in Northern India, which in turn depend on the rainfall.

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I have not traced any actual records for this species in the Presidency in August. There are a few records of the first Fantails being found in September as follows:—Coorg 14 September 1908, 18 September 1909 (Major J. C. Macrae); Cannanore 21 September 1929 (Major E. G. Phythian-Adams); Chingleput 28 September 1902, 11 September 1904 (R. F. Stoney); Madura 27 September 1903 (R. F. Stoney). The majority however do not appear until October or November and leave by the beginning of March though some may be found throughout the month. There are a few April records:—Palnis 3 April (Terry); Quilon 21 April (Giles, *J.B.N.H.S.*, xix, 749); Madura 6 April 1902, 5 April 1903, 13 April 1904 (R. F. Stoney). Birds seen on 4 May, Palnis (Terry), Palamcottah in April and May and at Vellore Railway Station (Theobald, Hume & Marshall, iii, 362) in May and June are said to have belonged to this species. As the Vellore and Palamcottah birds are said to have been in very poor condition and scarcely able to fly they may be disregarded as their late stay was doubtless due to shot wounds.

Mr. Stuart Baker (*Game Birds*, ii, p. 63) gives a map of the migration routes of this species, showing an orderly progress from north to south. It is well to remember that this map is merely a picture of what the author considers may occur, for existing records, which I have collated carefully, do not justify any such deductions. My own impression is, morever, that the Snipe arrive in a much more haphazard manner and that for Southern India the dates given are far too early. This species does not apparently reach Ceylon before December.

Capella media (Latham).

Scolopax media Latham, Gen. Synops. Birds, Suppl., vol. i (1787), p. 292—England.

It is somewhat curious that all three records of the Great Snipe in India refer to one small area of S.-E. India in places more or less in one straight line. Two of these are in the Presidency. The first specimen was obtained by Capt. C. Donovan, M.B.O.U., at Madras on 5 September 1899 under circumstances detailed in full in *J.B.N.H.S.*, xii, p. 782. The other was shot by Mr. G. L. Peters near Arkonam, N. Arcot district, on 30 March 1913 (Kinnear, *J.B.N.H.S.*, xxii, 631). This is not far distant from Bangalore where the third Indian specimen was shot by Capt. A. Boxwell on 28 October 1910 (*J.B.N.H.S.*, xx, 1155).

Capella stenura (Bonaparte).

Scolopax stenura Bonaparte, Ann. Stor. Nat. Bologna, vol. iv (1830), p. 335—Sunda Island.

The Pintail Snipe is quite easily the most abundant and the most generally distributed of the Game birds of the Presidency and there is therefore no need to give in full the various records that I have accumulated on its occurrence. On the eastern side of the Presidency it may be found and shot all along the coastal plains from the Chilka Lake through Ganjam, Vizagapatam, the Northern Sircars, the Godavery and Kistna rivers, Nellore, Madras, Chittoor, N. and S. Arcot, Chingleput, Tanjore to Madura, though on this side I have found no record whatsoever of its occurrence on the Ghats. On the western side it is similarly found throughout the suitable areas of the low ground from Cannanore to Travancore, extending also into the hills through Coorg and the Wynaad to the Nilgiris where it is found up on the plateau, to the Palnis and to the higher hills of Travancore, though here it appears to be scarce at more than moderate elevations.

The Pintail Snipe is chiefly a winter visitor to the Presidency though of course a large number of birds must drop in temporarily on passage on their way to and from Ceylon.

The earliest date on which I have any exact record of this Snipe in the Presidency is 27 August 1904 when Mr. Stoney shot one in Chingleput but Davison says that he has known it come in in the last week in August in the Nilgiris. The first arrivals may however usually be expected in September. I have accumulated the following records for September:—Cannanore 24 September 1927, 21 September 1929 (Phythian-Adams); Coorg 9 September 1932, 9 September 1934 (Betts); Nilgiris 28 September 1925, 23 September 1926,

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21 September 1933 (Phythian-Adams); 20 September 1931, 5 September 1932 (Stoney); Kistna 9 September 1905, 20 September 1923 (Stoney); Chingleput 15 September 1901, 21 September 1902, 28 September 1912, 20 September 1914 (Stoney); Tanjore 6 September 1908, 3 September 1909 (Stoney); and finally Madura 22 September 1901, 13 September 1903, 22 September 1914, 24 September 1916 (Stoney). Ferguson also says that a few stragglers arrive early in September in Travancore. The main body however do not come until considerably later probably towards the end of October or November, but it must be remembered that Snipe are far from regular in their movements which depend on the season and particularly the amount of water or drought not only in the Presidency but in other areas further north. They leave again in March though a few birds linger on into April and I have the following records for May:—Wynaad 5 May (Davison); Nilgiri Plateau 4 May (Phythian-Adams), 2 May 1922 (Limornin).

Mr. Stuart Baker (*Game Birds*, ii, p. 97) gives a map of the approximate dates on which the earliest examples (p. 95) of this species arrive at their respective destinations. This shows a regular progress southwards and westwards as if the birds travelled in regular stages and according to this map the terminal arrivals are Sindh 30 October and Ceylon 25 October and 1 November. Unfortunately for this map, Ticehurst has shown that in Sindh around Karachi he met with it on 11 September 1918 and 4 September 1919 (*Ibis* 1924, p. 133) while in Ceylon, according to Legge, it arrives in September, either early or late according to season. In that island, Butler's earliest date for it was August 31 (*J.B.N.H.S.*, x, 313). My own impression is that the Pintail Snipe does not arrive in the orderly progress suggested by the map but that it drops in more or less simultaneously in many widely spread localities. The earliest dates for the Peninsula in the map are at any rate evidently a month too late.

The Pintail Snipe is far more abundant in the Presidency than the Fantail both on the east and on the west. Wall gave an interesting summary of his shooting at Cannanore in the season 1903-1904 (*J.B.N.H.S.*, xv, 722). This shows a total of 354 Pintails as against 73 Fantails. Major Phythian-Adams has kindly given me his Snipe tables for Cannanore for the 10 seasons 1925-26 to 1934-35. 3,644 Pintails were killed in comparison with 856 Fantails. For the 12 seasons 1923-24 to 1934-35 on the Nilgiri Plateau 526 Pintails were killed and only one Fantail by the same sportsman.

Mr. R. F. Stoney has also been good enough to send me his Snipe tables for the Presidency for the 37 seasons from 1898-99 to 1934-35. These show a total of 13,530 Pintails and 2,312 Fantails for the whole period. The following are the more important district totals:—Nilgiris 383 Pintails and no Fantails; Coimbatore 121 Pintails, 6 Fantails; Madura 6,409 Pintails, 700 Fantails; Tanjore 331 Pintails, 110 Fantails; S. Arcot 259 Pintails, 99 Fantails; Chingleput 5,875 Pintails, 1,233 Fantails. These figures all show beyond question that in the main area of the Presidency the Pintail predominates very largely. In the north-eastern area this is doubtless not the case and it is interesting to note that Mr. Stoney's totals for this area, though not large, show very different proportions:—Nellore 25 Pintails, 55 Fantails; Kistna 89 Pintails, 63 Fantails; and Ganjam 20 Pintails, 35 Fantails.

Interesting notes by Mr. Stoney on the weight of Pintail and Fantail Snipe in the Presidency will be found in the *Journal* (xxiii, 778; xxv, 306).

Capella megala (Swinhoe).

Gallinago megala Swinhoe, Ibis 1861, p. 343—Amoy.

When Mr. Stuart Baker wrote his first account of Swinhoe's Snipe (*J.B.N.H.S.*, xx, 595) only two records of the species were known in the area covered by the *Fauna of British India*, namely from Dibrughar and the Shan States.

It was first identified in the Presidency in the shooting season of 1911-12. Mr. R. F. Stoney shot one in Chingleput on 3 December and one at Tindivanum on 3 March. Mr. Graham Ross shot one and Mr. I. S. Fraser shot three in the Chingleput district (*J.B.N.H.S.*, xxi, 1083). Since then Mr. Stoney kindly informs me that he has shot one in Chingleput on 30 September 1914, another in Madura on 29 November 1914 and a third in Madura on 3 November 1915.

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On the western side about Cannanore, Major E. G. Phythian-Adams has killed 15 in the 10 shooting seasons from 1925-26 to 1934-35. Of this one was shot on 21 September, 4 in November, 5 in December, 2 in January and 3 in February, the latest date being 22 February. Some of these were mentioned in *J.B.N.H.S.*, xxxii, 606.

We are, I think, now entitled to assume that it is a regular winter visitor to the Presidency in small numbers, occurring from September to March and somewhat generally distributed.

There are no specimens of Swinhoe's Snipe in the British Museum from Southern India but Major Phythian-Adams kindly sent me the two birds shot in 1935.

Lymnocryptes minimus (Brünnich).

Scolopax minima Brünnich, Orn. Bor. (1764), p. 49—Europe.

The Jack Snipe is a well-known winter visitor to the Presidency though it is never found in the large numbers of the Pintail and Fantail Snipes. I have traced no actual record of it in the north-east corner of the Presidency above the Kistna river and it is evidently scarce or absent in the hills. Otherwise it is so generally distributed that there appears to be no need to cite the records in full. Nellore, Madras, Chingleput, S. Arcot and Madura all contain much good snipe ground and Mr. R. F. Stoney's game books shew in these districts between 1898 and 1935 a total of 126 Jack Snipe killed.

On the western side Major Wall's bag for the 1903-1904 season at Cannanore shows 1 Jack Snipe out of a total of 465 head (*J.B.N.H.S.*, xv, 722). Major Phythian-Adams' record for this area for the 10 seasons 1925-35 shows a total of 58 Jack Snipe. They are doubtless similarly distributed through the rest of the low ground as near Nellamboor and Wondoor and in parts of Palghat and South Travancore (Hume & Marshall, iii, p. 375). A few birds mount on to the Nilgiris and Palnis but Major Phythian-Adams has only killed 2 on the Nilgiri plateau in the 12 seasons 1923-24 to 1934-35.

Bourdillon (*loc. cit.*) gives the stay of the Jack Snipe in South Travancore as from September to April, or the early part of May but this appears much exaggerated. A. Theobald, on the other hand, says that they come in about the end of November and leave again before the end of February. This is certainly a more correct estimate of the normal movements though Mr. Stoney's notes show 3 November and 9 November and 8 March and 10 March as early and late dates for the species.

(*To be continued*).

THE BIRDS OF BOMBAY AND SALSETTE.

BY

SALIM ALI and HUMAYUN ABDULALI.

Part II was not received in time for inclusion in this number. It will appear in the next issue.

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21 September 1933 (Phythian-Adams); 20 September 1931, 5 September 1932 (Stoney); Kistna 9 September 1905, 20 September 1923 (Stoney); Chingleput 15 September 1901, 21 September 1902, 28 September 1912, 20 September 1914 (Stoney); Tanjore 6 September 1908, 3 September 1909 (Stoney); and finally Madura 22 September 1901, 13 September 1903, 22 September 1914, 24 September 1916 (Stoney). Ferguson also says that a few stragglers arrive early in September in Travancore. The main body however do not come until considerably later probably towards the end of October or November, but it must be remembered that Snipe are far from regular in their movements which depend on the season and particularly the amount of water or drought not only in the Presidency but in other areas further north. They leave again in March though a few birds linger on into April and I have the following records for May:—Wynaad 5 May (Davison); Nilgiri Plateau 4 May (Phythian-Adams), 2 May 1922 (Limornin).

Mr. Stuart Baker (*Game Birds*, ii, p. 97) gives a map of the approximate dates on which the earliest examples (p. 95) of this species arrive at their respective destinations. This shows a regular progress southwards and westwards as if the birds travelled in regular stages and according to this map the terminal arrivals are Sindh 30 October and Ceylon 25 October and 1 November. Unfortunately for this map, Ticehurst has shown that in Sindh around Karachi he met with it on 11 September 1918 and 4 September 1919 (*Ibis* 1924, p. 133) while in Ceylon, according to Legge, it arrives in September, either early or late according to season. In that island, Butler's earliest date for it was August 31 (*J.B.N.H.S.*, x, 313). My own impression is that the Pintail Snipe does not arrive in the orderly progress suggested by the map but that it drops in more or less simultaneously in many widely spread localities. The earliest dates for the Peninsula in the map are at any rate evidently a month too late.

The Pintail Snipe is far more abundant in the Presidency than the Fantail both on the east and on the west. Wall gave an interesting summary of his shooting at Cannanore in the season 1903-1904 (*J.B.N.H.S.*, xv, 722). This shows a total of 354 Pintails as against 73 Fantails. Major Phythian-Adams has kindly given me his Snipe tables for Cannanore for the 10 seasons 1925-26 to 1934-35. 3,644 Pintails were killed in comparison with 856 Fantails. For the 12 seasons 1923-24 to 1934-35 on the Nilgiri Plateau 526 Pintails were killed and only one Fantail by the same sportsman.

Mr. R. F. Stoney has also been good enough to send me his Snipe tables for the Presidency for the 37 seasons from 1898-99 to 1934-35. These show a total of 13,530 Pintails and 2,312 Fantails for the whole period. The following are the more important district totals:—Nilgiris 383 Pintails and no Fantails; Coimbatore 121 Pintails, 6 Fantails; Madura 6,409 Pintails, 700 Fantails; Tanjore 331 Pintails, 110 Fantails; S. Arcot 259 Pintails, 99 Fantails; Chingleput 5,875 Pintails, 1,233 Fantails. These figures all show beyond question that in the main

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On the western side about Cannanore, Major E. G. Phythian-Adams has killed 15 in the 10 shooting seasons from 1925-26 to 1934-35. Of this one was shot on 21 September, 4 in November, 5 in December, 2 in January and 3 in February, the latest date being 22 February. Some of these were mentioned in *J.B.N.H.S.*, xxxii, 606.

We are, I think, now entitled to assume that it is a regular winter visitor to the Presidency in small numbers, occurring from September to March and somewhat generally distributed.

There are no specimens of Swinhoe's Snipe in the British Museum from Southern India but Major Phythian-Adams kindly sent me the two birds shot in 1935.

Lymnocryptes minimus (Brünnich).

Scolopax minima Brünnich, Orn. Bor. (1764), p. 49—Europe.

The Jack Snipe is a well-known winter visitor to the Presidency though it is never found in the large numbers of the Pintail and Fantail Snipes. I have traced no actual record of it in the north-east corner of the Presidency above the Kistna river and it is evidently scarce or absent in the hills. Otherwise it is so generally distributed that there appears to be no need to cite the records in full. Nellore, Madras, Chingleput, S. Arcot and Madura all contain much good snipe ground and Mr. R. F. Stoney's game books shew in these districts between 1898 and 1935 a total of 126 Jack Snipe killed.

On the western side Major Wall's bag for the 1903-1904 season at Cannanore shows 1 Jack Snipe out of a total of 465 head (*J.B.N.H.S.*, xv, 722). Major Phythian-Adams' record for this area for the 10 seasons 1925-35 shows a total of 58 Jack Snipe. They are doubtless similarly distributed through the rest of the low ground as near Nellamboor and Wondoor and in parts of Palghat and South Travancore (Hume & Marshall, iii, p. 375). A few birds mount on to the Nilgiris and Palnis but Major Phythian-Adams has only killed 2 on the Nilgiri plateau in the 12 seasons 1923-24 to 1934-35.

Bourdillon (*loc. cit.*) gives the stay of the Jack Snipe in South Travancore as from September to April, or the early part of May but this appears much exaggerated. A. Theobald, on the other hand, says that they come in about the end of November and leave again before the end of February. This is certainly a more correct estimate of the normal movements though Mr. Stoney's notes show 3 November and 9 November and 8 March and 10 March as early and late dates for the species.

(*To be continued*).

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THE SNAKES OF DEOLALI.

With Notes on their comparative Osteology and peculiarities of Dentition.

BY

A. G. L. Fraser, I.M.D.

(*With 3 plates and 1 text-figure*).

Part II.

(*Continued from page 82 of this volume*).

Variations in the Osteology of the Snake.

At the outset it may be remarked, that the various bones which enter into the formation of the endoskeleton, show marked specific differences in size, formation and shape, especially as regards the head so that, given two skulls of the same species, it would be easy to recognise them as belonging to one particular type. This type resemblance is, however, subject to individual deviations, as for example slight differences in one or other bones of the head. Sometimes a single specimen will differ slightly in the formation on one side of the head as compared with the opposite side. These variations, however, are minor in character and do not warrant separation from the unit presentation, which marks the type as a species. The skulls of young specimens are different from older adult ones, in that the occipital and parietal regions especially appear in the immature skull as much shorter and fused together without any clear definition between the two.

The same observations apply to the dentition. Family groups show differences from one another; but the specific characters in regard to number, kind and setting of the teeth in the various situations in the mouth are well maintained. In fact the type resemblance is preserved in a more regular way than is the case with the bones. Comparatively fewer examples of deviations are met with and the features of the dentition mark the species in more precise a manner for purposes of identification than is possible with the other characters snakes present and which are made use of for separating out the species and family groups.

The variations in the skull, dentition, and vertebral column of the families and species will be described in a general way in the

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text to follow and detailed in the systematic list of the species at the end of this paper.

The Endoskeleton of the Snake.

General characters:—The Ophidian axial skeleton is composed of two parts, skull and vertebral column.

Vertebral column:—The backbone is made up of a series of bony perforated segments (vertebrae) placed in articular apposition so as to form a canal, the continuity of which affords lodgement for and protection to the spinal cord. The vertebrae articulate with one another on the mechanical principle of a cup and ball joint and the articular facets known as the zygapophyses at the ends of the neural arches limit torsion and lateral flexion. There are no intervertebral fibro-cartilaginous discs. Instead the centra and arches are linked up by intervertebral ligaments of stout connective and elastic tissue, overlaid by muscles, which give a certain freedom between the successive vertebrae permitting of great flexibility in the column length.

The column can be divided into five sections:—(1) cervical, (2) thoracic, (3) dorsal, (4) cloacal, (5) caudal. These five divisions are well defined in certain species, but become purely arbitrary in others. These variable characters can best be studied in the table of variations and text-figures to follow. But before going on to outline the variations in tabular form, it will be necessary here to give in a general way a description of the characters of typical ophidian vertebrae. All the vertebrae are dorsally saddle-shaped. They present four surfaces:—dorsal, ventral, anterior, and posterior articular surfaces.

Dorsal surface:—This shows the neural arches and neural spines, which conjointly form the roof of the neural canal giving lodgement to the spinal cord. They vary specifically in formation, being for the greater part of the axial length, but more so in the posterior sector, fully-convexed, semi-convexed, or inclined outwards and downwards as in the two sides of a triangle. The anterior part is much narrower and shaped somewhat differently, in that the arch is a single one, having superiorly a slight convexity with its peaked ends supported by two laterally concaved walls, which flank the sides of the neural canal. This arrangement forms an articular surface for the posterior neural arches of the vertebra, which overlap it in front. The neural arches in the vertebrae of the Krait exhibit a unique divergence. In this respect, this snake is the only exception in the Deolali series, because of the winged extensions—or alae—projected laterally and upwards from the base of the neural arches on either side. Centrally in the axial length of the dorsal surface, the arches are ridged by neural spines, or spinous processes, which are thin squared plate-like extensions of bone uprising from the junction of the neural arches. These also vary specifically, being large, small, or rudimentary. The rudimentary variety shows the neural spines reduced to an indefinite ridge ending posteriorly in a small

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tubercle or eminence. In the cervical vertebrae the spines are finger-shaped processes rising abruptly from the anterior neural arches and terminating in a peak above the posterior arches.

Ventral surface:—This is formed by the centrum or body of the vertebra, which represents the notochord of the embryo now segmented and ossified and serving with the haemal arches joined to it above on either side as the floor of the neural canal. The centrum proper is seen ventrally lying, as if wedged in between the ossifications surrounding it, evidenced by this surface being grooved and ridged in the long axis. The centra of the vertebrae are procoelous, that is, the centrum is cylindrical with the anterior extremity showing a cupped depression or acetabulum and the posterior end a rounded head or protuberance. The acetabulum receives the articular epiphyseal head of the vertebra in front, whilst its own head articulates with the cupped depression of the vertebra behind. From below the epiphyseal head projected downwards and backwards is a process—the hypapophysis—which is present in the cervical and thoracic vertebrae of all snakes in Deolali, with one exception, namely, *Typhlops braminus*. The specific modifications arising from the presence or absence of this process in certain situations of the vertebral column are so greatly important that they will receive special consideration later, and need not be detailed here. Laterally on either side of the cupped depression are the articular processes for the ribs; they consist of a small protuberance joined by a bony ridge to a small process pointing downwards, formed partly by the centrum and partly by the continuity of the bone above it bearing the transverse processes and pre-zygapophyses. The ribs override the convexity of the bony ridge, protuberance and small process referred to above. The articulation thus formed enables the ribs to execute a wide sweeping, laterally depressed movement from before backwards, similar to the action of oars, when used in propelling a boat.

The anterior articular surface:—This shows the anterior face of the neural arch supported by two bony pillars joined below to the centrum, all of which enclose the neural canal. Lateral to the bony pillars and just below the peaked ends of the anterior neural arch are articular facets—the metapophyses, articulating with the sister facets or post-zygapophyses of the vertebra in front. The intervertebral notches for the passage of the spinal nerve lie below the metapophyses, being formed by the concavity resulting in the union of the lateral pillars of the neural arch with the pre-zygapophyses. The latter facets are borne upon the transverse processes and articulate with the opposing facets—the anapophyses of the vertebra in front. The transverse processes themselves are superiorly convex, inferiorly concave and laterally projected. At the junction of the transverse processes with the pre-zygapophyses are the interbraterial foramens. The transverse process laminae below enclose the acetabulum of the centrum and also form the small process, which takes part in the articular surface for the ribs.

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The posterior articular surface:—This presents the faces of the neural spine joined to the two posterior neural arches. These again are connected by the two haemal arches to the centrum below, which here, shows the protuberance or epiphyseal head previously mentioned. All of these surround the neural canal. On the inner aspect, below the neural and above the haemal arches at their internal junction, are the post-zygapophyses already described, as being in articulation with the metapophyses of the vertebra behind. At the lower extremity of the neural arches, at their external junction wih the haemal arches and inferior to the post-zygapophyses, are the anapophyses, which as previously mentioned articulate with the pre-zygapophyses of the vertebra behind. The concavity of the haemal arches form the roof of the intervertebral notches, which as stated give exit to the spinal nerves. Below the epiphyseal head of the centrum and projected ventrally downwards and backwards is a single haemal process, the hypapophysis. This process is of definite importance and merits attention, because by the presence or absence of it in certain situations the various species become divisible into four distinct groups. It should be noted that the hypapophyses of the vertebrae in the cloacal and caudal sections are not the single processes as evidenced in the cervical, thoracic and dorsal vertebrae. Instead they show the terminal end divided into two processes pointing downwards in a somewhat semicircular fashion and by the integumentary investments laterally and ventrally below it form a canal for the passage of the caudal artery and vein.

Based upon these distinctions the first group of snakes includes species, which possess the single hypapophysis in a markedly developed form and of nearly uniform length throughout the first three sections of the vertebral column. The second group shows the process well developed in the cervical and thoracic divisions and from thence feature a gradual diminution in its size up to the cloacal region. The third group presents the process in a well-developed and gradually decreasing form in the cervical and thoracic vertebrae alone and the total absence of it in the dorsal division. In the cloacal and caudal vertebrae of all the snakes in the above three groups, the process is present in the bifurcated form previously mentioned. The fourth group are entirely devoid of the process throughout the vertebral column. This vertebral grouping is shown arranged in the table on p. 268 along with other variations noted in the vertebrae of the various species in the four family groups at Deolali.

Dr. Boulenger (1893-96)[1] remarks upon the presence of the hypapophysis and its modifications in the vertebrae of the Colubrinae of Madagascar. He divides them into two series according to the differences shown in that process. He also mentions that the Hydrophidae show the neural spines and the hypapophyses in a very well developed form throughout the vertebral column.

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[1] 'A Catalogue of Snakes in the British Museum', by Dr. G. A. Boulenger (1893-96), vol. i, pp. 170-1. *Ibid.*, vol. iii, p. 265.

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TABLE III.—VERTEBRAL GROUPING BASED ON MODIFICATIONS IN THE HYPAPOPHYSIS OF THE VERTEBRAE IN DEOLALI SNAKES.

Species	Group	Hypapophyses				Neural spines	Other variations
		Large throughout and nearly uniform	Large and decreasing in size	Large in cervical and thoracic, absent in dorsal vertebrae	Absent throughout		
Typhlops braminus (Daud.) ...	IV	...	...	...	Yes	Nil	Very short caudal section. Rudimentary pelvis.
Python molurus (Linn.) ...	Not investigated				...	...	Short, thick caudal, vestigeal hind limbs Premaxilia dentigerous.
Eryx conicus (Schn.) ...	III	...	...	Yes	...	Rudimentary	Short, thick caudal section. Small and well-formed neural spines only on caudal vertebrae.
Nerodia piscator (Schn.) ...	I	Yes	...	...	...	Large	Tapering caudal.
Rhabdophis stolatus (Linn.) ...	I	Yes	...	...	...	Small	Do. do.
Polyodontophis subpunctatus (Dum. and Bibr.) ...	Not investigated				...	...	Do. do.
Macropisthodon plumbicolor (Cantor) ...	I	Yes	...	...	...	Large	Medium caudal length.
Lycodon aulicus (Linn.) ...	III	...	...	Yes	...	Small	Do. do.
Ptyas mucosus (Linn.) ...	III	...	...	Yes	...	Large	Tapering caudal.
Zamenis fasciolatus (Shaw) ...	III	...	...	Yes	...	Large	Do. do.
Coluber helena (Daud.) ...	III	...	...	Yes	...	Large	Do. do.
Oligodon arnensis (Shaw) ...	III	...	...	Yes	...	Small	Medium caudal length.
O. tæniolatus (Jerd.) ...	III	...	...	Yes	...	Small	Do. do.
Dipsadomorphus trigonatus (Schn.) ...	III	...	...	Yes	...	Small	Tapering caudal.
Dryophis mycterizans (Linn.) ...	III	...	...	Yes	...	Long and Small	Very long and whip-like caudal section. Vertebrae are long and narrow.
Bungarus cæruleus (Schn.) ...	II	...	Yes	...	...	Large	Medium caudal length. Neural arches are winged (Alæ).

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TABLE III.—VERTEBRAL GROUPING, ETC. (*Contd.*).

Species	Group	Hypapophyses				Neural spines	Other variations
		Large throughout and nearly uniform	Large and decreasing in size	Large in cervical and thoracic, absent in dorsal vertebrae	Absent throughout		
Naia naia, var *cæca* (Merr.)							
Naia tripudians (Merr.) ...	II	...	Yes	...	...	Small	Moderately Tapering caudal.
Callophis trimaculatus (Daud.) ...	II	...	Yes	...	...	Nil	Short caudal length.
Vipera russelli (Shaw) ...	I	Yes	...	...	...	Large	Do. do.
Echis carinata (Schn.) ...	I	Yes	...	...	...	Large	Do. do.
Species extraneous to Deolali							
Dipsadomorphus beddomei (Wall)	III	...	...	Yes	...	Small	Long and whip like caudal.
Polyodontophis collaris (Blgr.).	II	...	Yes	...	...	Small	Tapering caudal.

Dr. Sunder Lal Hora (August 1933)[1] commenting on the evolution of the respiratory organs in fish says:—'In all the instances that so far have been studied, there is strong evidence that the evolution or the modification of the respiratory organs in fishes is purposive, and that it is the direct result of the habits of the organisms concerned.' The question arises, as to whether the vertebral grouping based on the modifications of the hypapophyses noted in the vertebrae of the Deolali species bears any relation to the habits of the snakes involved. It is notable that the vertebral grouping, *per se*, actually places the majority of the snakes into a natural order consistent with the habits displayed. As this point is of some interest, it will be necessary here to digress in order to discuss these relations.

Group I, with *Nerodia piscator* as type, suggests a semi-aquatic mode of existence. The vipers, however, falling into this group furnish an obstacle, in that they are generally encountered in the open fields. The finding of the vipers on land though, does not necessarily preclude a semi-aquatic phase, which may be occasionally resorted to by them, but not generally observed and known. Our knowledge of the habits of snakes is greatly deficient

[1] 'Respiration in Fishes', by Sunder Lal Hora, D.SC., F.R.S.E., F.A.S.B., *Journ., Bombay Nat. Hist. Soc.*, vol. xxxvi, No. 3, p. 551 (15th August 1933).

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and the life history of any one of them has as yet not been completely ascertained. On a closer study of the snakes in the first group, the striking fact emerges that all of them without exception have the costal scales strongly keeled. Whether the keeling of the scales is purposive and a helpful feature in allowing of a semi-aquatic mode of life is difficult to say. *Nerodia piscator* is definitely known to be semi-aquatic in its habits—in fact spending more of its life in water than out of it. Excepting the vipers, the others in this group put in an appearance during the wet seasons and in the case of *Macropisthodon plumbicolor*, the writer has found aquatic frogs *Rana cyanophlictis* (Schn.) in the alimentary canals of very young specimens, 7 to 9 in. long, all of which were at Deolali recovered near to streams perennially flowing with water. That *Rhabdophis stolatus* aestivates during the dry weather and reappears with the monsoon is generally well known. Mr. Prater (April 1933)[1] in referring to this species says:—'Round Bombay these snakes disappear from the country side during the dry months but are abundant in our fields as soon as the rains break.' As regards the vipers, curiously enough all of them—8 in number—were secured in the riverain tract adjacent to Barnes' High School. On its south side in close proximity, the river Darna bounds the area. On the north side of the school is a tributary stream known as the 'Wadi'. The school stands on the highlands of the delta formed by these two rivers. The vipers were all localised to this area. Mr. Flynn (November 1932)[2] secured two Russell's vipers from a local snake charmer who assured him that he had caught them at a place a few miles from Malir Railway Station (about 18 miles from Karachi) in a vegetable garden not far from a pool of water. Again Mr. Rowland records the occurrence of the Russell's viper at Jherruck (Karachi District) on the Indus river (August 1933).[3] Dr. Corkill (February 1932)[4] emphasises the fact that the four specimens of *Echis carinata* in his survey came from the Middle Euphrates and none from elsewhere in Iraq. This area is subject to inundations. Turning to the evidence furnished by Col. Wall[5] in the distribution shown by him for these two vipers, we find the Russell's viper much more common in the basins of the great rivers, like the Irawady and Indus and other riverain lands.

Echis carinata is stated to extend through Rajputana (the particular locality is not defined), the Punjab, Sind and Baluchistan. All of these are coursed through by large rivers, excepting Rajputana and Baluchistan, which are less rivered and more sandy

[1] 'The Social Life of Snakes', by S. H. Prater, M.L.C., C.M.Z.S., *Journ., Bombay Nat. Hist. Soc.*, vol. xxxvi, No. 2, p. 472 (April 1933).

[2] 'The Family of a Russell's Viper', by A. A. L. Flynn, V.D., C.M.Z.S., *Journ., Bombay Nat. Hist. Soc.*, vol. xxxvi, No. 1, p. 271 (15th November 1932).

[3] 'Occurrence of the Russell's Viper in Lower Sind', by J. W. Rowland, *Journ., Bombay Nat. Hist. Soc.*, vol. xxxvi, No. 3, p. 758 (15th August 1933).

[4] 'The Snakes of Iraq', by N. L. Corkill, M.B., CH.B., F.Z.S., *Journ., Bombay Nat. Hist. Soc.*, vol. xxxv, No. 3, p. 570 (15th February 1932).

[5] 'The Poisonous Terrestrial Snakes of our British Indian Dominions etc, etc.', by Col. F. Wall, I.M.S., K.H.S., C.M.Z.S., pp. 53-4 and 59-61 (1928).

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and dry. In Baluchistan the terrain is for the most part barren, but it is undermined with subterranean water galleries locally known as 'Kraiz'. Col. Wall (1928)[1] quotes Vidal's figures for the Ratnagiri District (which has an annual average rainfall of 108 in.), where during 6 years Government rewards were paid on an average of 225,721 phoorsas (*Echis carinata*) per annum. When the reward was raised 115,921 were paid for in eight days from December 2nd to 10th, 1862. Although this snake has been declared to be a desert form, the location and immense numbers shown for it in Ratnagiri is certainly converse evidence. Relatively few have been found in the dry sandy regions and there is an absence of detailed information as to the particular localities in the wide stretch of desert lands like Rajputana. It would appear therefore that the peculiar habitat and distribution of these two vipers and possibly also other heavily keeled species of this family and the sub-family of pit vipers, are controlled and influenced by riverain tracts; that they tend more to hug the waterways and extend on either side up the tributary streams, widening their distribution as they go. The point as to whether or not there is a semi-aquatic phase necessitated in their life history requires investigation.

Group II, with the binocellate Cobra as the index point to purely terrestrial forms. This is shown by their habits. It is significant that all the Proteroglypha are included in this group.

Group III, with *Dryophis mycterizans*, a typical tree snake, indicates a semi-arboreal series or class with some scansorial powers. Most of the snakes in this category exhibit a capacity for climbing. The author in search of evidence on this point tried out living specimens belonging to this group and verified that five of these species are fairly efficient climbers, namely, *Dipsadomorphus trigonatus*, *Coluber helena*, *Oligodon arnensis*, *O. taeniolatus*, and *Lycodon aulicus*. The last of these gave the finest demonstration. They readily negotiate, though somewhat laboriously the perpendicular branches. The ascent is made in spiral corkscrew fashion by alternate sectional body grips. The cervical and thoracic regions first gain a hold and by muscular action the dependant parts of the body are drawn up. The caudal section then firmly secures a grasp, while the cervical slowly relaxes and follows the head in its further ascent assisted by the thoracic division, until in this entwining movement the elastic limits of these parts are reached. The caudal part then releases its hold and is drawn up with the dorsal section loosely encoiled. This latter region of the body appears to take no active part in the transaction. They can move easily and quickly over the broad leaves of the smaller branching tops of a monkey fig tree. All of these snakes are comparatively slender and light of body with tapering tails. There are two exceptions in the long and uniformly muscular species *Ptyas mucosus* and the shorter but stoutly formed *Eryx conicus*. A half-grown specimen of the

[1] 'The Poisonous Terrestrial Snakes, etc. etc.', by Col. F. Wall, I.M.S. (1928).

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former, 4 ft. 11 in. in length, was found on the sloping branch of a monkey fig tree, 15 ft. above the ground. There is no direct evidence to bear in the case of *Eryx conicus*, which is a constrictor. The power of constriction though in itself should facilitate climbing, while the fact that such snakes prey and feed on the squirrel suggests that they may be also partly arboreal. One of these snakes fell 30 ft. from the roof on to the verandah of a building and this at least is some evidence of its capacity for climbing. These two species, although anatomically correlative with and allied to group III, are nonetheless terrestrial in habits, because of other specialisations, such as the speed attainment of *Ptyas mucosus* and the constricting power and burrowing capacity of *Eryx conicus*. It is remarkable, that here again in these two species, there is featured a slight keeling of the costal scales. Thus the morphological variations occurring as they do in several directions suggest adaptations fitting them to a variegated mode of life, mainly terrestrial, partly arboreal and perhaps semi-aquatic.

In contrast with the aforementioned species, a Cobra 3 ft. 9 in. long was tested in order to assess its powers for ascending heights both vertical and slanting. It appeared to be considerably inhibited and did not show any prowess or sustained inclination for ascending even the sloping branch upon which it was placed. On the contrary it slid off and fell from a height of 10 ft. in its desire to regain 'terra firma'. This inability on its part may have been caused by fright. Mention has been made of the finding of a pipistrel in the stomach of one of these snakes, which points to apparent if not real evidence of a climbing capacity. The species in this group, however, are mainly terrestrial in their habits.

In group IV, there is but one species belonging to the family Typhlopidae, namely, *T. braminus*. This worm-like snake is typically burrowing. Observations, as regards *Eryx conicus* and *Oligodon taeniolatus*, showed evidence of a like habit. When kept in captivity in boxes well filled with sand and earth, both these snakes remained during daylight at a depth of 4 in. or more in the case of the former and 2 in. in the latter. A gardener in raking up the gravel on a garden walk, brought to light a small *Oligodon taeniolatus*. The snake hurriedly burrowed into the sand again and insistently repeated the act on the several occasions when it was disinterred. In the case of the other species maintained alive in sanded boxes, namely, (1) *Dipsadomorphus trigonatus*, (2) *Oligodon arnensis*, (3) *Lycodon aulicus*, (4) *Macropisthodon plumbicolor*, (5) *Naia naia*, (6) *Coluber helena*, (7) *Nerodia piscator*, there was no evidence of burrowing habits. Rather on the other hand (2), (3) and (6) experienced no difficulty in clinging to the narrow divisions in the angles formed by the top and side panels of the box and remained in that position all day, descending to the floor only at night. Number (7) rested during the day immersed in the water receptacle, sometimes with its snout just above the water level. The others when diurnally inactive coiled themselves on the sand itself.

It should be mentioned that in Group I, *Macropisthodon plumbicolor* displayed evidence of some scansorial powers and surpris-

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ingly enough, when hanging by its tail from a metal ring at the end of a long metal rod, it was able to draw itself up by a reversed muscular action directing the body backwards. It would appear then that the vertebral variations and the differences in the scaled exoskeleton suggest evolutionary gradations adapting the snakes in various ways to the selected mode of life. The references[1] studied on the subject of variations in the vertebrates, indicate that the modifications may be in the nature of progressive and retrogressive mutations brought about possibly by environmental factors, as a sequence of natural selection in their evolution from some pre-existing marine type. The standard development attained would be represented by the characters presented in the typical species, which occupy the key positions in each group.

Variations in the Vertebrae and Ribs of the Deolali Species.

The vertebrae commencing with the cervical series are small in size. The numbers vary in the different species and range from 3 to 8. They are recognised by the neural spines presenting finger-like processes and the hypapophyses being well developed. The thoracic vertebrae, in contrast, show the neural spines as squared plate-like extensions.

The Atlas or 1st cervical vertebra, as will be noted in the text-figures, shows minor individual differences in the formation dependant upon the kind of snake. The articular principle is the same in all and is in no way involved. The Atlas is unique in character and consists of a narrow bony ring, broader superiorly, and inferiorly constricted. The dorsal surface is comparatively narrow and the neural spine is rudimentary. The ventral surface has an abbreviated hypapophysis.

The anterior articular face has two apertures separated by a cartilaginous septum. The superior or neural canal is roofed over by the neural arches for the passage of the spinal cord. The inferior aperture receives in articulation the single condyle on the occipital bone of the skull. It is bounded on either side by the haemal arches and these along with the superior surface of the hypapophysis form three articular depressions, which fit corresponding eminences and the condyle of the occipital bone.

The posterior articular face presents similar features, as outlined above and articulates with the axis. Projected laterally and

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[1] 'The Origin of Species', by means of natural selection, by Charles Darwin, M.A. (1917 reprint of first edition published in 1859-60).

'Manual of Zoology', by H. A. Nicholson, M.D., D.Sc., Ph.D.(Gott.), F.L.S., F.G.S., 7th edition, p. 43 (1887).

'General Biology', by J. F. Abbott, Professor of Zoology in Washington University, pp. 199-241 (1914).

'Zoology', by E. W. MacBride, F.R.S., pp. 73-81 (1918).

'The Evolution of Living Organisms', by E. S. Goodrich, F.R.S., pp. 27-69 (1918).

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posteriorly from either side of the junction of the neural with the haemal arches are processes in the nature of cervical ribs. Above these at the termination of the neural arches are roughened surfaces, which represent the post-zygapophyses.

The axis or 2nd cervical vertebra is in all snakes 1 mm. larger than the 1st cervical, except in the case of *Dryophis mycterizans*, in which it is half a millimetre larger; this vertebra is also subject to slight individual differences dependant upon the length, the size, and kind. The dorsal and ventral surfaces show more accentuated neural spines, arches and hypapophyses. There are two of the latter processes on the ventral surface—the broader projected downwards from the anterior end has been designated in the text-figures as the haemal process in order to distinguish it from the posterior process or hypapophysis proper.

The anterior articular face articulating with the Atlas, shows the neural arches covering the neural canal joined to the Odontoid process, which projects forward as a prominent bony extension fitting into the lower aperture on the posterior articular face of the Atlas. Below the Odontoid is the haemal process already mentioned.

The posterior articular surface shows the neural spines somewhat extended to a peak and the neural arches joined to the centrum, which here features a protuberance or epiphyseal head. Below this is the hypapophysis. From the junction of the neural arches with the haemal arches spring the cervical ribs which are much larger than those noted in the Atlas.

The successive cervical vertebrae increase in size, each being one millimetre larger than the preceding one and in *Dryophis mycterizans* half a millimetre larger. Except for the finger-like neural spines in some snakes they show the same features as have already been described for a typical vertebra.

The thoracic vertebrae in sequence gradually increase in size—length, width and depth—and are similar in character to a typical vertebra, numbering from 33 to 36. The largest dimensions are attained about the middle of the vertebral column in the anterior dorsal series. From thence there is a corresponding diminution up to the tip of the caudal section. The dorsal vertebrae vary in number and may be from 80 to 130 or more dependant upon the length of the snake.

The cloacal and caudal vertebrae show the same features as described in a general way for a vertebra in any of the other sections of the vertebral column, but they are differentiated from them by the presence of short processes in the nature of false ribs. The vertebrae in the cloacal section also vary in number, sometimes being four in some and three in others, irrespective of the sex. So also in the caudal division, the numbers of the vertebrae vary and depend upon the species and caudal length and may be in the count from 23 to 140 vertebrae. The last three caudal segments are very minute and inseparably fused.

A striking variation noted is that relating to the total number of vertebrae in the body length. This is not a constant figure

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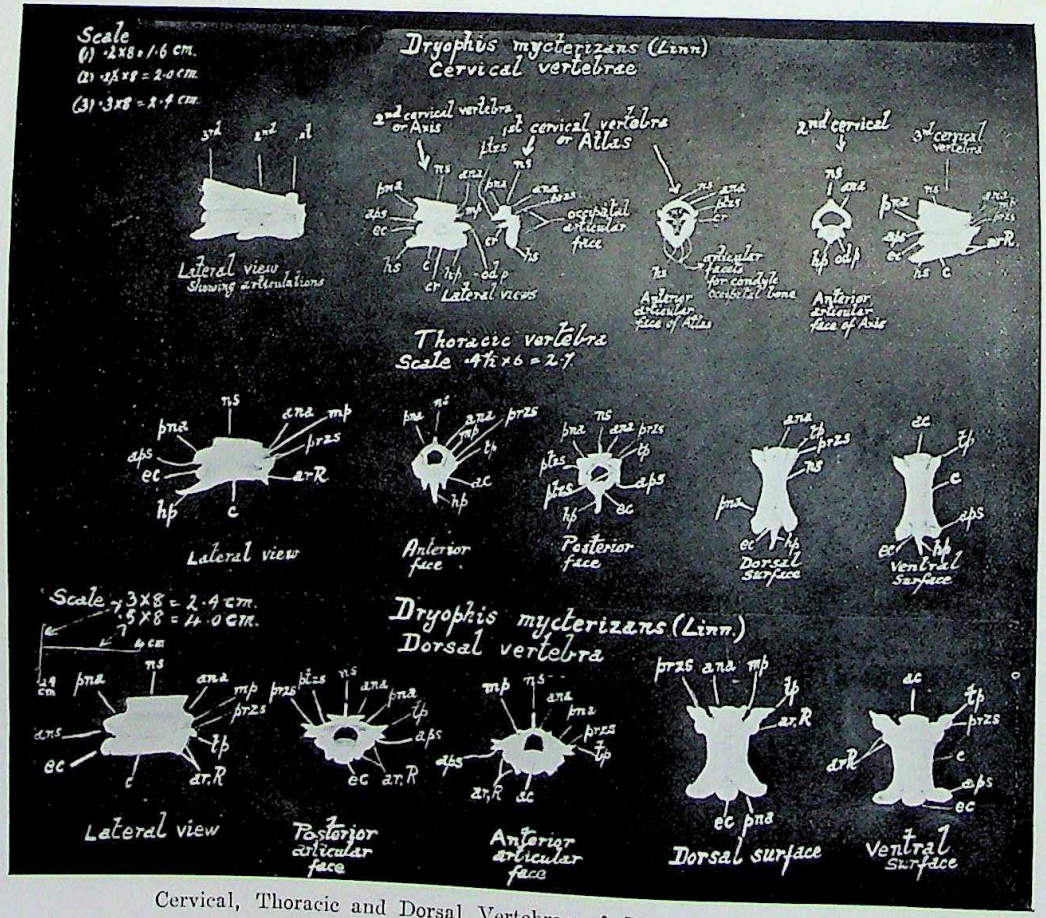

Cervical, Thoracic and Dorsal Vertebrae of *D. mycterizans* (Linn.).

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and differs in the count even in the same species. A similar meristic variation is encountered in the numbers of the ventral plates on the belly. The ventral shields and the vertebrae are numerically closely correlated. The ventral shields correspond exactly with the number of vertebrae provided with free and true ribs. A pair of these articulate with each vertebra in the cervical, thoracic, and dorsal divisions, excepting the first and second cervical, which are devoid of them, but as previously stated show short rudimentary projections in the nature of cervical ribs fused with the body of the vertebra. The true ribs terminate at the junction of the last dorsal vertebra with the first cloacal. The cloacal and caudal vertebrae on the other hand, although, having no free articulating ribs attached, show in the cloacal series a pair of short rigid processes inseparably fused on either side with the vertebral bodies and in the caudal section one shorter rigid process on either side similarly ankylosed to the bodies of the vertebrae. These short rib-like extensions diminish in length proportionately with the decrease in size of the vertebrae from the region of the vent backwards and disappear in the last three fused caudal segments in which they are reduced and represented by tubercles. All of these pseudo ribs are shaped like the true ribs with the convexity on the dorsal aspect, except in the case of the second and lower placed processes of the cloacal group, which are convex on the ventral surface and curve outwards and upwards toward the superiorly positioned process. They in continuity with the true articular ribs round and mould the body in these regions. There is no sternum in snakes. The distal ends of the ribs are free. The terminal points are cartilaginous, somewhat bulbous in some and pointed in others, and attached by muscular, connective and elastic tissue to the abdominal scutae. They thicken in the length from without inwards toward the proximal or vertebral termination. The dorsal convexity of the rib is ridged and the ventral concavity is rounded. It is slightly flattened in the dorso-ventral diameter and broadens out at the vertebral end, where it consists of a transversely placed rod of bone, which presents three articular portions: (1) capitulum or head of the rib, (2) tubercle of the rib, with a slight depression anterior to it, and (3) small process for the attachment of ligaments. The whole of this articular surface is adapted to fit corresponding formations previously described as in the vertebra and completing the suspensorium or articular arrangements for the ribs. The lengths of the ribs vary in snakes. They are of uniform length throughout in some species, others show the shorter lengths attached to the cervical and thoracic, gradually increasing and being longest in the midbody, and then decreasing proportionately toward the vent. Again as in the Cobra, the longest ribs are those in the cervical and part of the thoracic regions corresponding to the position of the hood, which in fact is caused and produced by muscular action extending the ribs and expanding the neck parts of the exoskeleton. The co-operation of the muscles, ribs and the ventral plates secures mobility and locomotion.

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The Anatomical Relations of the Vertebral Column with the Underlying Organs and Viscera.

The underlying organs and viscera help in an arbitrary way in distinguishing the various sections of the vertebral column, because by their approximate relative positions the vertebral divisions become designated. In this respect, these relations are of some value in those species falling into the vertebral groups I, II and IV, in which the peculiarities of the vertebral hypapophyses, as previously outlined present difficulties in separately defining them. In mentioning these relations, advantage will be taken of the opportunity here offered to briefly describe the viscera and organs.

The relations in the case of the cervical and thoracic vertebrae, which for convenience will be considered together, are the alimentary canal, trachea, tongue and heart in the majority of snakes, but in some the anterior parts of the lungs and liver also become involved. The first two vertebral divisions roughly extend over one-third of the body length. The dorsal section, dependant upon the species and in particular the caudal length, is generally the greatest in extent. Under these varying conditions the situation of the organs and viscera differs in the various snakes.

The stomach consists of a long, distensible, funicular membrane in correspondence with the elongated form of the snake. There is no distinction as between the oesophageal tube and gastric envelope, or stomach proper, as seen in the higher vertebrates. It lies above the trachea and tongue and anteriorly communicates with the mouth. Posteriorly it unites with the intestines by a pyloric thickening.

The trachea is long and tubular and composed of cartilaginous loops, which are ventrally un-united and held together by a fibro-elastic investment. Around this again is a membranous covering. Anteriorly the laryngeal opening lies in the mouth above the tongue. The hissing snakes use this during the respiratory act by constricting the aperture in order to produce the characteristic sound. Posteriorly it terminates in a blunted open end directly into the canal of the right lung. There are no bronchial tubes and no ramifications of them into the lung substance. The posterior section of the trachea, close to the terminal lung end, is in relation with the heart.

The tongue lies below the trachea and is attached to it for approximately half its length. It is bifid and contractile and consists of two cylindrical lobes of muscular tissue sheathed in a connective tissue investment to which on either side and bound by similar integument in close apposition are attached the two filamentous hyoid bones. These are of bristle-like thickness in the smaller snakes. They exhibit both rigidity and resilience, and measure from 2 to 4 in. in length, dependant upon the kind and length of the snake. The terminal points of these bones are embedded in the mouth by a fibro-cartilaginous union, direct with the subcutaneous tissue of the epiderm forming the floor of the lower jaw between the two mandibles. The position of this

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attachment varies in the different species. It is placed somewhat forward in the mouth in those that hiss like the cobra, krait, and most vipers, and lower down in others at a point corresponding with the base of the skull. The tracheal aperture coincides with these fixation points and is situated superiorly above them and closely and firmly bound with the investment sheathing the tongue and the hyoid bones. The posterior attachment of the tongue and also that of the hyoid bones to the trachea for two-thirds of their lengths is of a loose and free nature, being but thinly covered by fascia lata. The hyoid bones at this extremity meet behind and enclose the tongue, which is attenuated and firmly welded to them by the investments. The muscular action of the tongue causes the protrusions and at the same time draws up and arches the hyoid bones, which limit the extent of its protractility. Retraction of the tongue is effected by muscular relaxation and by the return of the hyoid bones to their former rigidity, by which action the tongue is pulled back into its position in the mouth. Apart from the action of the hyoid bones, the tongue itself has in part an elastic recoil. This mechanism enables the snake to use the tongue in the peculiar manner so often seen.

The heart lies a little above the junction of the trachea with the lungs and is partly supported by them and enveloped in the pericardial serous membrane. It is three-chambered, consisting of right and left auricles, completely divided by a septum, and behind these the connecting ventricle. This is partly sectioned, but actually consists of only one chamber. Communicating with the heart cavities are the main blood vessels. These are the right and left aortic arches, the pulmonary artery and vein, and the vena cava inferior. Anterior to the heart and supported partly by its investments lies the thyroid gland. The position of the heart varies in the species. In some it is situated below the tracheal union with the lungs and it is then partly supported by the lungs.

The lungs are unsymmetrical lobes. The right lung is elongated and tubular. The left lung is rudimentary in character and in the majority of snakes is missing. The right lung is well developed and ends posteriorly in a membranous recess or air chamber. This is a marked feature in *Nerodia piscator*, in which it is a sausage-shaped capacious cavity. The lungs are largely reticulated capillaries, between which are air spaces. They are positioned dorsally above and related with the heart, stomach, and the anterior parts of the liver. Normal respiration in the snake is timed at 3 per 65 seconds.

The liver consists of two long, cylindrical lobes, the larger and longer lobe lying to the right side and connected by a long hepatic duct to the gall bladder which in most snakes is detached at some varying length behind and away from the right lobe, at a point corresponding roughly to the middle of the body. The anterior end of the liver is connected to the heart by blood vessels. The posterior terminal point of the right lobe ends a little below the junction of the stomach with the small intestines, both of

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which lie laterally on the left. The thoracic vertebrae here terminate at a point midway in the liver length.

The dorsal vertebral division is in relation with the posterior half of the liver, the gall bladder and its duct, the lower end of the air reservoir, the terminal end of the stomach, the small and large intestines, the urino-genital appendages and organs.

The small intestine lies to the left side of the body and is transversely folded and covered by its mesenteric investments. Here also in the larger species is a protective padding of fat lobules lining the ventral aspect. The small and large intestines are connected by an ileo-caecal union where also lies the pancreas. Lateral to the large intestines on either side are placed the female ovaries and oviducts and the male vasa deferentia, which are long and open by separate apertures into the cloaca. The left ovary and oviduct appear rudimentary. Dorsally above the genitals lie the urinary appendages terminating in the papillae urinary situated in the common cloacal aperture. There is no urinary bladder in the snake. The terminations of the large intestine and the urino-genital appendages are in relation with the cloacal vertebrae.

The caudal vertebral section:—Here there are only muscles and no organs. On the ventral surface posterior to and immediately behind the vent on either side are two small pores connected by very short ducts to two glands, which secrete a liquid substance. This fluid varies both in colour and consistency in the different species, being creamy white, serous yellow, or dark and viscid. The physiological significance and function of these glands are obscure. It is believed to be hedonic. These glands are termed scent glands by Mr. Prater (1933),[1] who from the existing evidence as to the association of the sexes and the widespread belief that the mate can trail out its dead companion to wherever the latter may have been taken, advances the theory subject to certain reservations, that by the scent given off from the glandular secretions, the sexes may be able to trace and find each other. This is believed to be the function of the two pairs of glands, one pair located in the throat and the second in the region of the vent, in crocodiles. Lizards too have femoral pores exuding a fluid said to serve some such purpose. In the case of the snakes however, as Mr. Prater observes, 'It is true in many species of snakes these glands have been found to be active in all stages of growth even in hatchlings which are not sexually mature, and as such it is argued that the glands are not directly connected with the sexual functions of the snake.' The same features also appear in the crocodile and instances are quoted of baby crocodiles and alligators everting the glands inside out like the fingers of a glove when held by force. The glands are stated

[1] 'The Social Life of Snakes', by S. H. Prater, M.L.C., C.M.Z.S., J.P., *Journ., Bombay Nat. Hist. Soc.*, vol. xxxvi, No. 2, p. 469 (15th April 1933).

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to be active during the breeding season and can be stirred to function under stress of fear and excitement. It is regretted that no proper record was maintained on this aspect in the survey at Deolali. The impressions gained however were that from young, half-grown, and some adult specimens no gland juice could be expressed. The adults and especially the gravid females certainly produced a heavy secretion with a faint peculiar smell which became oppressive when decomposed. In the instance of an adult male killed by sun rays, it was found that the genital organs had prolapsed, as they were protruding from the vent a little before death actually occurred. The glands were also exuding their juice. Cover slip and film preparations both from the organ and gland were separately made and microscopically examined. That from the genital organ showed dead spermatozoa and cellular matter while the gland fluid was composed of cellular debris alone. This male was a *Macropisthodon plumbicolor*. The secretion from the glands of the gravid females showed in addition to the cellular content numerous fat globules. The other males in this survey showed dead spermatozoa in the expressed seminal secretions. It is presumed that the zoosperms were dead because of the absence of motility, which one would expect in post-mortem specimens investigated some time after death. But in the first case quoted, the expectation was to find motile sperms, because the secretion was taken and examined at a time when the snake was in a coma and still breathing fitfully. The heart was also faintly audible on auscultation. Under the circumstances the death of the spermatozoa which were all possessed of very long flagellae can only be attributed to the hyperpyrexia. It is hoped at some future time to further explore the point connected with the viability of the zoosperms.

It may be that the function of the gland juice is intended as Mr. Prater suggests to guide the sexes together during the, as yet unknown, periods of the breeding seasons. In the association of the sexes, also, the glands are possibly stimulated under the influence of the autonomic nervous ganglia, or the homologue of the 'nervi erigentes', which must exist most probably in the cloacal region, whereby the glands of the sexes secrete fluids, the admixture of which at insemination form a medium suitable and necessary for the viability of the spermatozoa until they are able to reach the oviduct.

The Skull.

In the snake the skeleton of the head is well ossified and made up of the cranium proper or brain case, which occupies the posterior part of the skull behind the orbital apertures, and the several bones forming the anterior half of the skull inclusive of the olfactory capsules.

The cranial bones are the basi-occipital, ex-occipital, and the supra-occipital. The basi-occipital serves as the floor of the posterior section of the cranial cavity and ventrally limits the

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foramen magnum, where are featured the single condyle and the two small eminences articulating with the Atlas.

The ex-occipital superiorly forms the roof of the posterior section of the brain chamber and is in some species ridged by a crest of bone, the supra-occipital, at the junction with the parietals.

The parietal bones form practically the entire roof of the encephalon. In the young immature skulls, centrally dividing the bones can be seen the sagittal suture, which becomes obliterated or nearly so in the older skulls. The bones end posteriorly in a terminal point at the union with the supra-occipital.

The sphenoidal bones are the basi-sphenoid, the ali-sphenoids, the pre-sphenoids and the orbito-sphenoids. The basi-sphenoid is a median plate of bone inferiorly supporting the brain. In the vipers there is a process projected downwards from it and posteriorly curved and resembling in shape and formation the hypapophyses of the vertebrae. It serves for the attachment of the longus colli muscle. The ali-sphenoids are wing-like bones fused with the basi-sphenoids. They help in forming the floor of the cranial cavity and are loosely related with the ecto-pterygoids and palatine bones. The sphenoid is a forward extension of the basi-sphenoid.

The pre-sphenoids are laterally compressed with the basi-sphenoids and in them the optic foramen is an aperture through which the optic nerve connects the eye with the brain. Attached to the pre-sphenoids are the lamellar orbito-sphenoids surrounding partially the optic foramen and forming a wall separating the cranium from the orbital aperture. These bones are continued forward as the vertical inner walls of the orbit.

The squamosal bones are two separate, flat and long bones which vary in shape and length in the species possessed of it. They are placed above the periotic region in articulation with the mastoid surface and in relation with the occipital and parietal bones. At the posterior portion of the free ends of the squamosals, the quadrate or tympanic bones articulate.

The periotic comprise the auditory, mastoid and temporal regions of the cranium. They consist of the pro-otic, epiotic and opisthotic. In the adult skull they are fused to form an irregular mass. Laterally below the squamosal bones the face of the periotic is ridged and perforated by apertures. These are the fenestra rotunda, fenestra ovalis and the foramen for the 5th nerve. The fenestra ovalis takes part in the auditory apparatus by the attachment of the Columella Auris to a stapes or stirrup-like plate on its posterior lip. The Columella Auris is a thin round rod of bone, which represents the ossicles of hearing and at its spatulate ends, by fibrous unions, connects up the periotic with the quadrate or tympanic. The hearing apparatus of the snake appears structurally rudimentary and defective. The ossicles are merely vestigeal in character and there is no membranum tympanum proper and no external auditory meatus. Furthermore there are the peculiar anatomical dispositions of the muscles; namely: the digastric; the temporalis anterior, middle,

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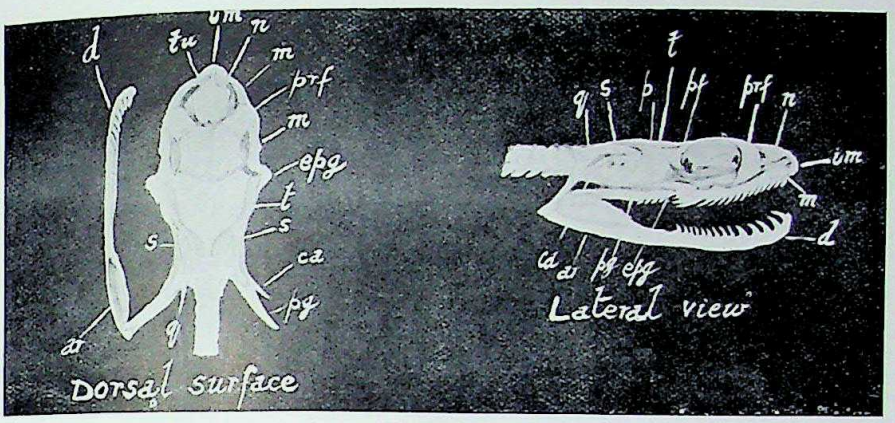
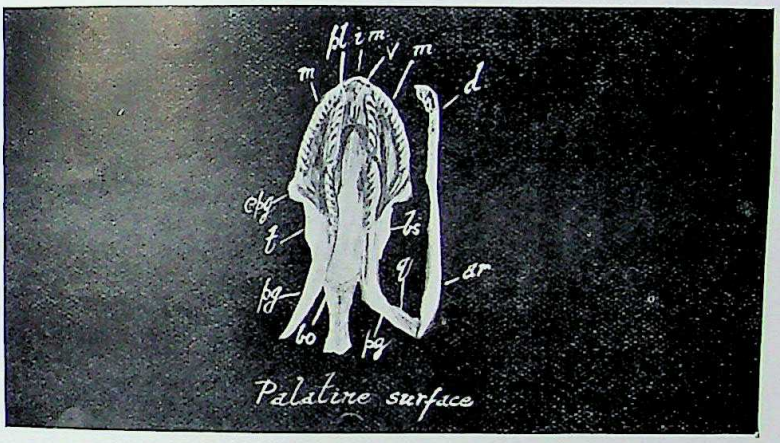
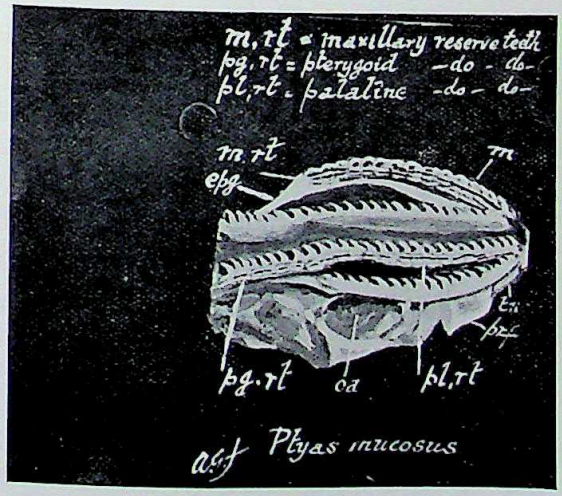


Skull of *Dipsadomorphus beddomei* (dorsal and lateral view).



Skull of *D. beddomei* (ventral view).



Skull of *Ptyas mucosus* (ventro-lateral view).

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and posterior; the cervico-squamosal; the cervico-angularis, and the sub-occipito-angularis, which are well developed especially in the vipers; as well as large poison glands, overlaid upon the periotic surface and around the Columella Auris. The latter must be considerably inhibited in the reception of sound waves and under the circumstances audition in the snake cannot be very helpful. This is borne out by the very behaviour of snakes. The vipers certainly act as if they were deaf; and the majority of them exhibit more a dependancy upon the acuity of vision and probably the sense of smell to guide them rather than hearing.

The bones entering into the formation of the anterior half of the skull are the frontals, post- and prae-frontals, nasals, inter-maxillary or praemaxilla, ethmo-turbinals and the vomers. The separate bones in articular relation with some of the foregoing are the maxillaries, palatines, ecto-pterygoids and pterygoids. These are bound by cartilaginous septa, muscles and ligaments and kept in position.

The frontals in young specimens are divided mid-dorsally by sutures, which are absent or represented by denser lines of ossifications in the older skulls. They are thin plates of bones placed centrally between the orbital apertures, where superiorly above the pre-sphenoids they also partly roof it. From the anterior portion a slender plate of bone is projected vertically downwards partitioning the olfactory passages in the ethmoidal region.

The post-frontals lie in the posterior corner of the orbit and furnish the zygomatic process, which circularly bounds the posterior part of it.

The prae-frontals form the anterior orbital arch and superiorly are suturally united with the frontals and separated from the nasals by a depression which is bridged over by cartilaginous connections.

The nasals are thin bony plates suturally divided in the axial length and lying in front of the frontals, to which they are posteriorly united by peaked terminals. Medially they broaden out and anteriorly end in a point. They vary in shape in different species. They cover the maxillo-turbinals and naso-turbinals and anteriorly help to form the nasal apertures of the exoskeleton.

The intermaxillary or praemaxilla is suturally united with the nasals and is projected forward and downwards, convexed dorsally and anteriorly and terminating in two lateral processes, which are folded inwards to align with the ends of the maxillary bones nearly touching them. In *Python molurus* this bone is dentigerous.

The turbinal bones lie beneath the nasals and mainly form the olfactory capsules consisting of the maxillo-turbinals and the naso-turbinals which bound the nasal cavities.

The vomers are rounded bony plates fused with the turbinal bones on their ventral aspects. They occupy the anterior section in the roof of the mouth just behind the intermaxillary.

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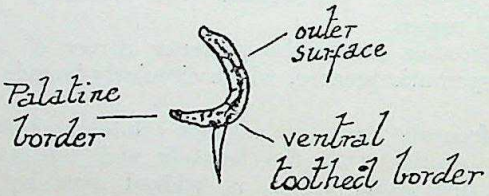
The maxillary bones are the most important in the skull of the snake. The variations in their size, length, and formation, and particularly the dental features, as has been stated, help in the differentiations between the families Colubridae and Viperidae. To these bones are ankylosed the poison fangs, which play so significant a part in distinguishing the Thanatophidia. The variations in the maxillary bones and the dentition will be better appreciated by a reference to the text-figures of the species dealt with. It was emphasised earlier in this paper that in the Colubridae the maxillary is long, thin and horizontally positioned, whereas in the Vipers it is thick, short and obliquely set.

The maxillaries are placed laterally on either side of the upper jaw. They are in relation anteriorly with the praemaxilla and on their inner aspects with the palatines and pterygoids, to both of which they are joined by cartilaginous connections. Posteriorly they directly articulate with the ecto-pterygoids or transpalatine bones. It is by means of these latter bones that the maxillaries can be depressed and protracted forward by muscular action, and thus erect the fangs to assist in the act of biting and also in holding and swallowing a bolus of food. The formation is angular throughout its length, in the aglypha and opisthoglypha. A dorso-ventral section would appear as in the following diagram.



Superiorly the bones articulate with the inferior border of the prae-frontals and in the ventral surface of the bone are embedded the grooved fangs of the poisonous species and the non-perforated teeth of the aglyphous types.

The ecto-pterygoids function chiefly in the act of biting and swallowing. They are long, medium or short in length according to the kind of snake. In most of them the anterior part is flat and broadly spatulate. Dorsally it is slightly convex and angular and placed in articulation over the posterior end of the maxilla. Posteriorly it thins out and terminates in a point, where it is in direct articulation with the pterygoid. This arrangement conforms to the principle in Dynamics, whereby muscular action as the 'Power' equivalent exerted along its dorsal surface depresses the anterior end lying on the maxilla, which represents the 'Weight' to be lifted, while the 'Fulcrum' is the articular point resting upon the pterygoid. In the Vipers the anterior portion of the bone is broadened out into a winged expansion articulating at almost a right angle with the obliquely set maxilla.

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The palatines are two vertically fixed plates placed in the roof of the mouth on either side of the vomers and between the maxillaries. The palatines themselves are divided by the central cavity forming the nasal and orbital apertures opening into the mouth and roofed over by the sphenoid. They are in relation with the maxillary bones in front and posteriorly are joined with the pterygoids near to or a little below the nasal apertures in the mouth. On the ventral aspect are ankylosed some solid teeth, varying in number, from 3 to 9, in the different snakes.

The pterygoids are two vertically set bony plates, anteriorly narrow and running almost parallel with each other on either side below the sphenoid to which they are ventrally related. They broaden out from near the articulation of the ecto-pterygoid and extend backwards past the base of the skull curving laterally outwards, backwards, and downwards, terminating in a point, which in many species touches the articular end of the mandible. The posterior parts of the bone are grooved either ventrally or laterally. To the ventral and inner ledge are attached numerous non-perforated teeth.

The ethmoidal region lies below the frontals in front of the cranial cavity. Posteriorly the cribriform plate partitions the brain chamber and through its perforations pass the olfactory nerves to the brain. Fused with the cribriform plate are laminae which form the nasal cavity.

The lower jaws are the mandibles on either side. They consist of two parts generally, but in the Typhlopidae and some of the other related families, of three parts, namely, a dentary portion, a ramus or articular part, and a coronoid. These several parts are suturally united. A symphysis attachment unites them in front and allows of a certain elasticity by which snakes are able when swallowing to operate either side independently. As in most bones of the snake, here too, there are variations in the formation. The most divergent type is that seen in *Polyodontophis collaris*, in which the dentary is sharply angulated inwards. The dentition in this snake in all its toothed jaw bones, upper and lower, is characteristically specific, in that the teeth are peg-topped and quite unlike any of the other species in Deolali, in which the teeth show fine points. In *Typhlops braminus*, the dentary is unprovided with teeth, while in other species there is set on its superior aspect a varying number of non-perforated teeth.

The moveable quadrate bones articulating superiorly with the squamosals of the skull and inferiorly with the lower jaw bones, complete the mandibular arch which is thus formed posteriorly. Above, the quadrate is generally broadly spatulate, and laid on the posterior section of the squamosal. It ends below in a protuberance fitting into a notch on the articular end, or the ramus of the mandible. This arrangement allows of a great lateral distension of the jaws and permits of a forward and backward extension of the mandibles to a remarkable degree.

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TABLE IV.—COMPARATIVE MEASUREMENTS OF THE SKULL AND VERTEBRAL COLUMNS OF THE SPECIES IN CENTIMETRES.

	No. of Specimens.	ENDOSKELETON				Column		Exo-Skeleton	Sex
		Skull							
		From tip of intermaxillary to occipital base	From tip of intermaxillary to inner aspect of anterior orbital arch	Diameter of orbit in the long axis	From orbital aspect of postfrontal zygoma to occipital base	From Atlas to tip of tail	Total length of skull and column	Length of Exoskeleton complete	
Typhlops braminus (Daud.)	1	0·4	0·1	0·½	0·2½	16·4	16·8	18·7	Not ascertained
	2	0·3	0·1	0·½	0·1½	14·0	14·3	15 5	do.
	3	0·2	0·1	0·½	0·½	6·3	6·5	7·5	do.
Eryx conicus (Schn.)	1	1·3	0·4	0·3	0·6	21·2	22·5	30·0	Female
	2	1·3	0·4	0·3	0·6	...	...	...	do.
	3	1·3	0·4	0·3	0·6	...	...	...	do.
	4	1·8	0·6	0·3	0·9	34·0	35·8	43·7	do.
	5	2·5	0·9	0·4	1·2	69·0	71·5	80·5	do.
Nerodia piscator (Schn.)	1	1·1	0·3	0·3	0·5	24·5	25·6	28·7½	do.
	2	1·3	0·3	0·3	0·7	36·2	37·5	40·0	do
	3	1·9	0·5	0·4	1·0	59·5	61·4	67·5	do.
	4	2·0	0·5	0·4	1 1	86·2	88·2	97·5	do.
	5	2·4	0·7	0·6	1·1	89·0	91·4	93·7	do.
	6	2·9	1·1	0·6	1·2	...	...	...	do.
Rhabdophis stolatus (Linn.)	1	1·3	0·4	0·3	0·6	44·5	45·8	53·7	do.
Macropisthodon plumbicolor (Cantor.)	1	0·9	0·2	0·3	0·4	11·1	12·0	13·0	do.
	2	1·0	0·2	0·3	0·5	21·2	22·2	23·5	do.
	3	1·1	0·3	0·3	0·5	25·4	26·5	31·2	do.
	4	1·6	0·4	0·4	0·8	45·0	46·6	53·7	Male
	5	1·8	0·5	0·5	0·8	48·4	50·2	58·7	Female
	6	1·8	0·5	0·5	0 8	56·5	58·3	...	do.
	7	1·8	0·5	0·5	0·8	56·8	58·6	60·5	do.
	8	1·9	0·5	0·5	0·9	62·1	64·0	69·0	do.
	9	2·0	0·5	0·5	1·0	64·5	66·5	69·0	do.
	10	2·2	0·6	0·5	1·1	66·1	68·3	71·5	do.
Lycodon aulicus (Linn.)	1	0·8	0·2	0·1	0·5	14·2	15·0	20·0	do.
	2	0·9	0·2	0·1	0·6	19·6	20·5	26·0	do.
	3	1·0	0·2	0·2	0·6	27·3	28·3	34·0	do.
	4	1·5	0·4	0·3	0·8	50·0	51·5	55·0	do.
	5	1·5	0·4	0·3	0·8	47·3	48·8	57·5	do.
	6	1·6	0·5	0·3	0·8	51·2	52·8	63·0	do.
	7	1·6	0·5	0·3	0·8	49·5	51·1	65·0	do.
	8	1·8	0·5	0·4	0·9	60·0	61·8	73·5	do.

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TABLE IV.—COMPARATIVE MEASUREMENTS OF THE SKULL, ETC. (*Contd.*).

	No. of Specimens.	ENDOSKELETON				Column	Total length of skull and column	Exo-Skeleton	Sex
		Skull							
		From tip of intermaxillary to occipital base	From tip of intermaxillary to inner aspect of anterior orbital arch	Diameter of orbit in the long axis	From orbital aspect of postfrontal zygoma to occipital base	From Atlas to tip of tail		Length of Exoskeleton complete	
Ptyas mucosus (Linn.)	1	3·4	1·1	0 9	1·4	212·0	215·4	225·0	Female
	2	3·2	1·0	0·8	1·4	175·5	178·7	185·0	do.
Zamenis fasciolatus (Shaw)	1	1·9	0·6	0·5	0·8	76·7	78·6	90·0	Male
	2	2·2	0·6	0·6	1·0	104·8	107·0	117·5	Female
Coluber helena (Daud.)	1	2·0	0·7	0·4	0·9	74·5	76·5	80·0	do.
	2	2·5	0·9	0·4	1·2	91·1	93·6	105·0	do.
Oligodon arnensis (Shaw)	1	1·1	0·3	0·2	0·6	29·5	30·6	35·0	do.
	2	1·0	0·2	0·2	0·6	29·0	30·0	33·5	do.
Oligodon tæniolatus (Jerd.)	1	0·7	0·2	0·1	0·4	18·0	18·7	20·0	do.
	2	0·8	0·2	0·2	0·4	25·9	26·7	27·5	do.
	3	0·9	0·3	0·2	0·4	39·5	40·4	42·0	do.
Dipsadomorphus trigonatus (Schn.)	1	0·9	0·2	0·2	0·5	12·5	13·4	2	Not ascertained
	2	1·1	0·2	0·3	0·6	47·0	48·1	50·0	Female
	3	1·4	0·3	0·4	0·7	57 0	58·4	62·5	Male.
	4	1·4	0·3	0·4	0 7	61·6	63·0	67·5	Female
	5	1·4	0·3	0·4	0·7	58·6	60·0	64·5	do.
	6	1·5	0·4	0·4	0·7	76·0	77·5	82·5	do.
	7	1·5	0·4	0·4	0 7	...	...	...	do.
Dryophis mycterizans (Linn.)	1	2·2	0·9	0·4	0·9	107·8	110·0	115·0	do.
Bungarus cæruleus (Schn.)	1	1·1	0·3	0·2	0·6	46·4	47·5	50·0	do.
	2	2·1	0·6	0·4	1·1	82·7	84·8	88·0	do.
	3	2·5	0·6	0·6	1·3	109·0	111·5	115·3	do.
Naia naia, var. *cæca* (Merr.) Cobra (binocellate).	1	2·0	0·6	0·5	0·9	...	...	...	do.
	2	2·1	0·6	0·5	1·0	81·5	83·6	88·7	do.
	3	2·2	0·6	0·5	1·1	76·1	78·3	85 0	do.
	4	2·3	0·6	0·5	1·2	...	...	...	do.
	5	2·4	0 6	0·6	1·2	78·7	81·1	85·0	do.

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TABLE IV.—COMPARATIVE MEASUREMENTS OF THE SKULL ETC.—(*Continued*).

Species	No. of Specimens	ENDOSKELETON				Column		Exo-skeleton	Sex
		Skull							
		From tip of intermaxillary to occipital base	From tip of intermaxillary to inner aspect of anterior orbital arch	Diameter of orbit in the long axis	From orbital aspect of postfrontal zygoma to occipital base	From Atlas to tip of tail	Total length of skull and column	Length of Exoskeleton complete	
Callophis trimaculatus (Daud)	1	0·5	0·1	0·1½	0·3½	21·0	21·5	23·0	Female
	2	0·5⅓	0·1	0·1½	0·3	26·0	26·5½	8·5	do.
Vipera russelli (Shaw)	1	3·0	1·0	0·7	1·3	121·0	124·0	135·0	do.
Echis carinata (Schn.)	1	1·0	0·2	0·4	0·4	23·0	24·0	25·0	do.
	2	1·2	0·3	0·4	0·5	29·0	30·2	32·5	do.
	3	1·4	0·3	0·4	0·7	43·1	44 5	47·5	do.
Dipsadomorphus beddomei (Wall)	1	1·5	0·4	0 4	0 7	83·0	84·5	90·0	do.
Polyodontophis collaris (Blgr.)	1	1·5	0·4	0· 3	0·8	73·5	75·0	85·0	do.

POISON GLANDS.

These glands are of various kinds and constitute the homologues of the salivary glands in the higher vertebrates. In the snake, however, they are more complex in structure and specialised for a twofold purpose, defence and digestion.

In the *Thanatophidia* the glands are large and aciniform, particularly in the larger species such as the Cobra, the Krait and some of the vipers, and proportionately graded in snakes of smaller size like *Callophis trimaculatus*. They are placed behind the eye, between it and a point near to the squamosal bones and are lobulated membranous sacs both secreting and storing venom in fair quantities up to 1 c.c. The glands in the vipers are denser in structure and the venom required for immediate use is collected in a mucous capsule anterior to the fang. There is also a glandular chain along and under the supralabials (upper lip) and in some species along the outer side of the dentary below the teeth.

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The Opisthoglyphous Colubridae are possessed of a salivary gland. In the Deolali species the salivary or parotid gland was found lying along the upper lip, below and away from the eye and reaching up to the angle formed by the upper and lower lip. The glands were flat, tough, dull yellow structures, shotty to the feel. There was found an additional bilobed gland situated immediately behind the eye and against it in the temporal region near to the zygomatic process of the post-frontal bone. The uppermost lobe appeared to be in the nature of a sac and contained a glairy fluid.

Some of the aglyphous Colubridae are provided with both parotid and temporal glands. But in these the parotid glands show as large, soft, lobulated masses, white in colour in contrast with the presentation seen in the opisthoglypha.

Again other aglyphous snakes showed the presence of parotid glands alone, similar in formation to those mentioned above for the same class.

The species in the survey at Deolali are grouped as under.

A. Specialised aciniform glands served by reservoir:—

COLUBRIDAE: 'PROTEROGLYPHA'.

Naia naia, var. *caeca* (Merr.) Binocellate Cobra.
Bungarus caeruleus (Schn.) Krait.
Callophis trimaculatus (Daud.) Slender Coral Snake.

VIPERIDAE: VIPERINAE.

Vipera russelli (Shaw) Russell's Viper.
Echis carinata (Schn.) The Saw-scaled Viper 'Phoorsa'.

B. Hard, yellow, parotid gland and bilobed temporal gland:—

COLUBRIDAE: 'OPISTHOGLYPHA'.

Dipsadomorphus trigonatus (Schn.) Common Cat Snake.
Dryophis mycterizans (Linn.) The Green Whip Snake.
Dipsadomorphus beddomei (imported into Deolali).

C. Soft, white, parotid gland and a single temporal gland:—

COLUBRIDAE: 'AGLYPHA'.

Lycodon aulicus (Linn.) The Wolf Snake.

D. Soft, large, white, parotid gland only:—

COLUBRIDAE: 'AGLYPHA'.

Nerodia piscator (Schn.) The Checquered Water Snake.
Rhabdophis stolatus (Linn.) The Buff-striped Keelback.
Polyodontophis collaris (extraneous to Deolali).
Macropisthodon plumbicolor (Cantor) The Green Keelback.
Ptyas mucosus (Linn.) The Rat Snake 'Dhaman'.
Zamenis fasciolatus (Shaw) The Fasciolated Rat Snake.
Oligodon arnensis (Shaw) The Banded Kukri Snake.
Oligodon taeniolatus (Jerd.) The Variegated Kukri Snake.

E. Small single temporal gland only:—

COLUBRIDAE: 'AGLYPHA'.

Coluber helena (Daud.) The Trinket Snake.

BOIDAE: 'BOINAE'.

Eryx conicus (Schn.) The Earth Boa (red).

TYPHLOPIDAE.

Typhlops braminus (Daud.) The Worm Snake.

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Mechanism of the Bite.

Dr. Fairley[1] at a meeting of the Royal Society of Medicine (June 1934) dealt with methods of taking dental impressions of the bite and the significance of the 'maxillary index' and the 'quadrate index' which he had introduced for determining the biting efficiency of the Australian colubrids. In snake-bite four distinct phases were recognized: (1) the strike; (2) opening the mouth and elevation of the fangs; (3) closing the mouth and the injection of venom; (4) retraction of the fangs. In the Australian colubrids there was a wide range of variation in the mobility of the fangs, the degree of elevation from extreme retraction to maximal protraction varying from 10-15 to 45-50 in the different species studied. Each pterygo-palatine-transverse arch acted as a single entity, and when the protractor muscles of the palate drew the endo-pterygoid forward, they invariably brought with it the palatine bone and the ecto-pterygoid which impinged on the posterior arm of the maxilla, driving the maxilla forwards and upwards on the articulating surface of the prefrontal. This produced a variable degree of elevation and forward rotation of the fangs which were ankylosed to the inferior surface of the maxilla; its extent could be judged by the angle formed at the ecto-pterygoid maxillary junction which, in the resting position, formed a straight line. Should this movement be doubted it could readily be demonstrated by pithing the snake, dissecting up the mucous membrane on the roof of the mouth and electrically stimulating the protractor and retractor muscles acting on the palatine arch; alternatively skulls could be prepared with the palatine arch in different positions. In these snakes the smaller the maxilla (i.e., the greater the maxillary index) the greater the forward movement of the pterygo-palatine-transverse arch and the greater the degree of forward projection of the fangs. This mechanism differed from that of the vipers, in which the movement of the maxilla on the prefrontal was a true rotary one and not a forward and upward sliding movement as described above.[2]

In the mechanism of the bite, emphasis is thus laid upon the significant factors of the maxillary and quadrate indices. As the maxillary index is governed by the size of the maxillary bone, the biting efficiency of any snake other than the viper, becomes dependant upon the possession of a small maxilla. The application to the Deolali series of the principle enunciated results in the following serial order into which the species fall in accordance with the length of their maxillary bones. The figures have been ascertained by actual measurement of the skulls and maxillary bones. The lengths of the quadrate bone have also been included to show the comparative proportions between it and the maxillary bone.

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[1] Fairley (N. Hamilton), 'Snake Bite: Its Mechanism and Modern Treatment', *Proc. Roy. Soc. Med.* (June 1934), vol. xxvii, No. 8, pp. 1083-91 (Sec. Trop. Dis. and Parasit., pp. 45-53).

[2] *Tropical Diseases Bulletin*, vol. xxxii, No. 5 (May 1935).

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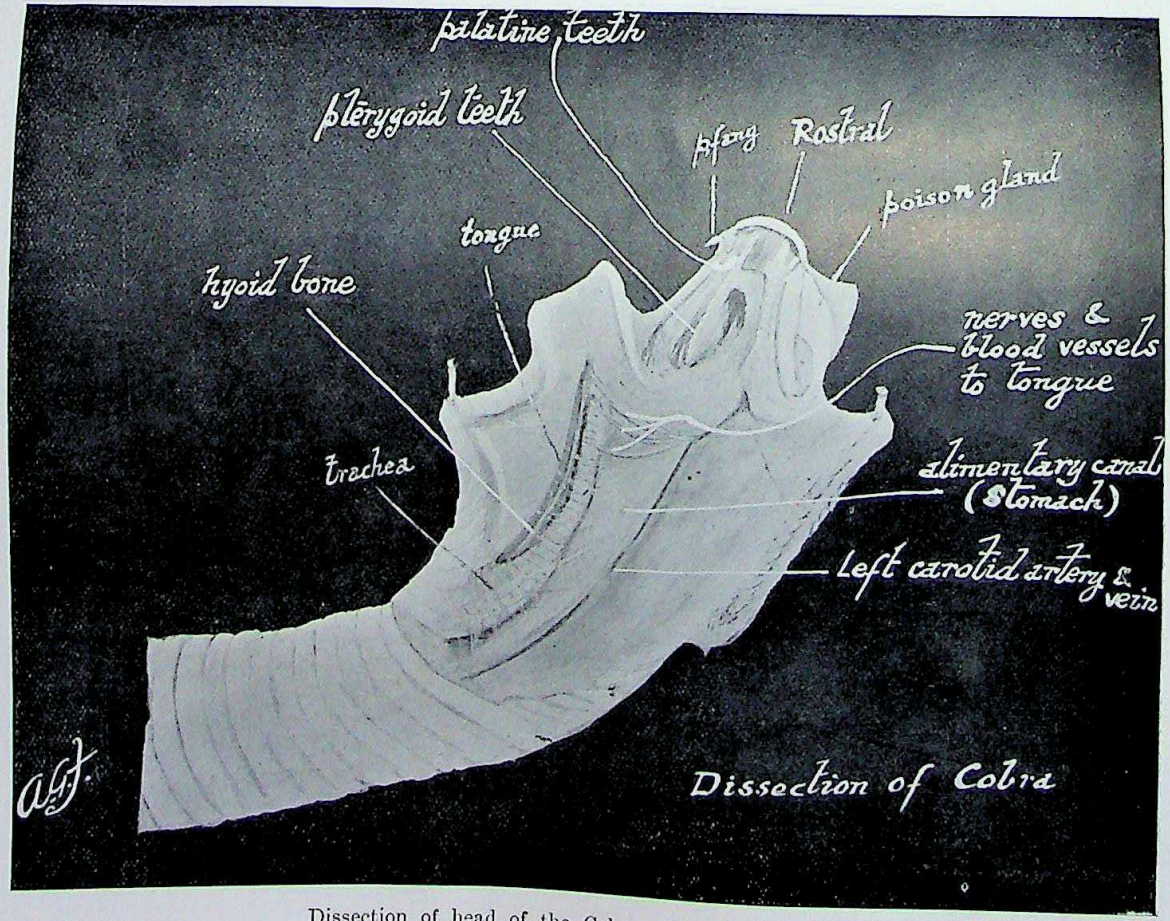

Dissection of head of the Cobra (*Naia naia*, Merr.).

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TABLE V.—SHOWING THE COMPARATIVE LENGTHS OF THE MAXILLARY AND QUADRATE BONES OF THE COLUBRIDAE FOUND IN DEOLALI.

(Measurements in Centimetres.)

Species	Length of Skull (cm.)	Length of Maxilla (cm.)	Length of Quadrate (cm.)
Proteroglypha			
Callophis trimaculatus (Daud.)	0·5½	0·1	0·1
	0·5	0·1	0·1
Bungarus cæruleus (Schn.)	2·5	0·5	0·4
	2·1	0·4	0·3
	1·2	0·3	0·2
Naia naia, var. *caeca* (Merr.)	2·4	0·6	0·9
	2·3	0·5	0·8
	2·2	0·5	0·8
	2·1	0·5	0·8
	2·0	0·4	0·8
Opisthoglypha			
Dipsadomorphus trigonatus (Schn.)	1·5	0·8	0·6
	1·4	0·7	0·5
	1·4	0·7	0·5
Dryophis mycterizans (Linn.)	2·3	1·3	0·5
Aglypha			
Oligodon tæniolatus ((Jerd.)	0·9	0·3	0·2
	0·8	0·3	0·2
	0·7	0·2	0·2
Oligodon arnensis (Shaw)	1·1	0·5	0·2
	1·0	0·4	0·2
Lycodon aulicus (Linn.)	1·5	0·6	0·3
	1·3	0·6	0·3
	1·0	0·4	0·2
	0·9	0·4	0·2
	0·8	0·3	0·2
Rhabdophis stolatus (Linn.)	1·3	0·7	0·4
Mocropisthodon plumbicolor (Cantor)	2·0	1·1	1·1
	1·9	1·0	1·0
	1·8	0·8	0·9
	1·6	0·7	0·8
Nerodia piscator (Schn.)	2·4	1·4	0·9
	1·9	1·0	0·5
	1·1	0·6	0·3
Zamenis fasciolatus (Shaw)	1·9	0·9	0·5
	2·2	1·0	0·6
Coluber helena (Daud.)	2·5	1·6	0·6
	2·0	1·5	0·6
Ptyas mucosus (Linn.)	3·4	1·9	1·3
	3·2	1·9	1·1

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TABLE V.—COMPARATIVE LENGTHS OF THE MAXILLARY AND QUADRATE BONES—(*Continued*).

Species	Length of Skull (cm.)	Length of Maxilla (cm.)	Length of Quadrate (cm.)
Colubridæ extraneous to Deolali			
Ohpisthoglypha *Dipsadomorphus beddomei* (Wall)	1·5	0·8	0·6
Aglypha *Polyodontophis collaris*	1·5	1·0	0.7
Boidæ found in Deolali			
Eryx conicus (Schn.)	2·5	1·3	0·6
	1·8	0·9	0·4
	1·3	0·6	0·3

In the above Table, it will be observed that there are variations in the lengths of the maxillary and quadrate bones, even in the same species. It may not be remarkable, but it is none the less significant that the *Thanatophidia* should head the list by the possession of comparatively smaller maxillary bones. The evidence in these figures definitely confirms the findings of Dr. Fairley and small maxillary bones appear to be a specialization in the snake determining its biting efficiency. In the figures shown for the Cobra, it follows that the younger snakes would be able to project their fangs much more forward and therefore become capable of more effectively injecting a lethal dose than could the older ones in whom the lower maxillary index functions less efficiently. This also supports and explains Dr. Lamb's[1] estimate (quoted by Col. Wall, 1928) that 30 per cent of Cobra-bitten subjects escape with a sub-lethal dose.

EXPLANATION OF LETTERING ON PLATES III AND IV.

ana,—Anterior neural arch. aps,—Anapophysis. ac,—Acetabulum centrum. ar,—Articular ramus. ar, R,—Articular surface for rib. bo,—Basi-occipital. bs,—Basi-sphenoid. cr,—Cervical rib. cor,—Coronoid. c,—Centrum. cv,—Cervical vertebra. ca,—Columella auris. d,—Dentary. eo,—Exoccipital. epg,—Ecto-pterygoid (or transpalatine). ec,—Epiphysis centrum. f,—Frontal. fm,—Foramen magnum. fo,—Fenestra ovalis. fr,—Fenestra rotunda. fvn,—Foramen for 5th nerve. hs,—Hypapophysis. hp,—Haemal process. im,—Intermaxillary (praemaxillary). irp,—Inferior rib process. lf,—Lacrymal foramen. me,—Mandible. m,—Maxillary. md,—Mastoid. mp,—Metapophysis. ns,—Neural spine. na, a,—Neural arch alae. of,—Optic foramen. oa,—Orbital aperture. odp,—Odontoid process. od,—Odontoid. og,—Orbital groove. pl,—Palatine. pg,—Pterygoid. prf,—Praefrontal. pf,—Postfrontal. pc,—Periotic. przs,—Praezygapophysis. ptzs,—Postzygapophysis. pna,—Posterior neural arch. p,—Parietal. q,—Quadrate (tympanic). rfg,—Reserve fang. s,—Squamosal. sg, or gs,—Gland sulcus. sp,—Sphenoid. so,—Supra-occipital. srp,—Superior rib process. tu,—Turbinal. tp,—Transverse process. t,—Temporal. v,—Vomer.

[1] 'The Poisonous Terrestrial Snakes of our British Indian Dominions, etc., etc.', by Col. F. Wall, I.M.S., K.H.S., C.M.Z.S., p. 75 (1928).

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A NEW CARTON-BUILDING SPECIES OF ANT IN SOUTH INDIA

CREMATOGASTER DOHRNI ARTIFEX, MAYR.

BY

P. N. KRISHNA AYYAR,

Lecturer in Entomology, Agricultural College, Coimbatore.

(*With four plates*).

INTRODUCTION.

This remarkable species of arboreal ant was discovered by the writer for the first time in S. India in the Sirumalai hills in the vicinity of Dindigul town at an elevation varying from 2,500 ft. to 3,000 ft. While on a brief visit to those tracts with a party of Agricultural Students, early in January 1935, these insects attracted his attention by the huge globular dark brown nests, about the size of a foot-ball, attached to branches of various trees on either side of the track at a height of about eight to nine feet from the ground. Those spherical enclosures were conspicuous in appearance and were built round and embracing some fairly stout and healthy branches of certain trees. Besides the larger branches, several smaller ones passed right through the nests giving them additional support. The nests, which were full of ants at the time of collection, were singular both in the material used in construction and in their architecture; and the writer was naturally struck with admiration at the wonderful foresight and great ingenuity displayed in their construction.

The inhabitants of these curious nests are neither large nor attractive in appearance. The ant concerned is comparatively a very small one, ferrugineous in colour and varying in size from 3 to 5 mm.; but it is certainly one of the most skilful and talented of all the tribes. The head is somewhat larger and square and the thorax is provided at the hind part with a pair of prominent sharp spines. A slender nodulose waist or pedicel connects the flat triangular abdomen to the thorax. The abdomen itself is a shade darker than the rest of the body and is often held bent over and between the spines. The body has a thin covering of abundant fine silky pubescence. So far as is known there is no published record of this species in S. India and probably this is the first record of its occurrence in this country.

Since very little is known about this species of ant an attempt was made to make a thorough study of its biology and habits. With this end in view fresh nests were obtained from the same locality and were kept for observation and study for months together. Some experiments were also conducted to elucidate the natural history of the species concerned.

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The Nest.

In South India the species is probably confined to the Sirumalai hills since no records of its capture from any other locality are to be found. The nests are fairly abundant in the wooded parts of those hills. They are very nearly globular enclosures built around branches. Generally the site chosen for their construction is at a point where one or more branches diverge. The main branch around which the nest is built does not necessarily run through the middle of it, and rarely exceeds $1\frac{1}{2}$ in. in diameter. Several smaller branches are often included in the formation of the nest and these vary in diameter from $\frac{1}{10}$ to very nearly $\frac{3}{4}$ of an inch. The supporting branches are all sound and healthy and bear good green foliage, and, therefore, no direct damage is apparently caused to that part of the branch where the nest is located.

Shape and colour.—The nests are generally globular, subspherical or ellipsoidal, but may vary from oblong to cylindrical in some exceptional cases (photographs). They are good, solid nests having the appearance and colour of decomposed and dried cow-dung. The general colour is dusky or dark brown with the hardness and consistency of crude card-board.

Size.—The largest nests are about the size of an ordinary foot-ball the maximum length and thickness noted being 12 and 9 in. respectively; but there is a considerable range of variation in size and in shape. The following measurements of half a dozen nests may furnish a good idea of the extent of this variation.

Shape	Length	Thickness
1. Largest size, more or less ovoid (Pl. I)	$11\frac{1}{2}$ inches	$9\frac{1}{4}$ inches
2. Elongate cylindrical, one end broadly rounded and the other less obtusely rounded	12 ,,	7 ,,
3. Ellipsoidal nest Fig. 2	$7\frac{1}{2}$,,	$5\frac{1}{2}$,,
4. Medium size—oblong	11 ,,	6 ,,
5. Small round—subspherical ...	6 ,,	5 ,,
6. Small size, slightly damaged ...	4 ,,	3 ,,

External Architecture.—The nest is made up of a multitude of thin rough, very often leaf-like sheets, composed of a material which has the appearance (as mentioned already) of dried cow-dung. The outer envelope is more or less uniform, but at irregular intervals on the surface there are numerous convex bulges in the form of irregular blisters. These blisters or projections, on careful examination were found to be eave-like extensions with small arched openings on their under surface. These openings are gateways for the ingress and egress of the ants; they are

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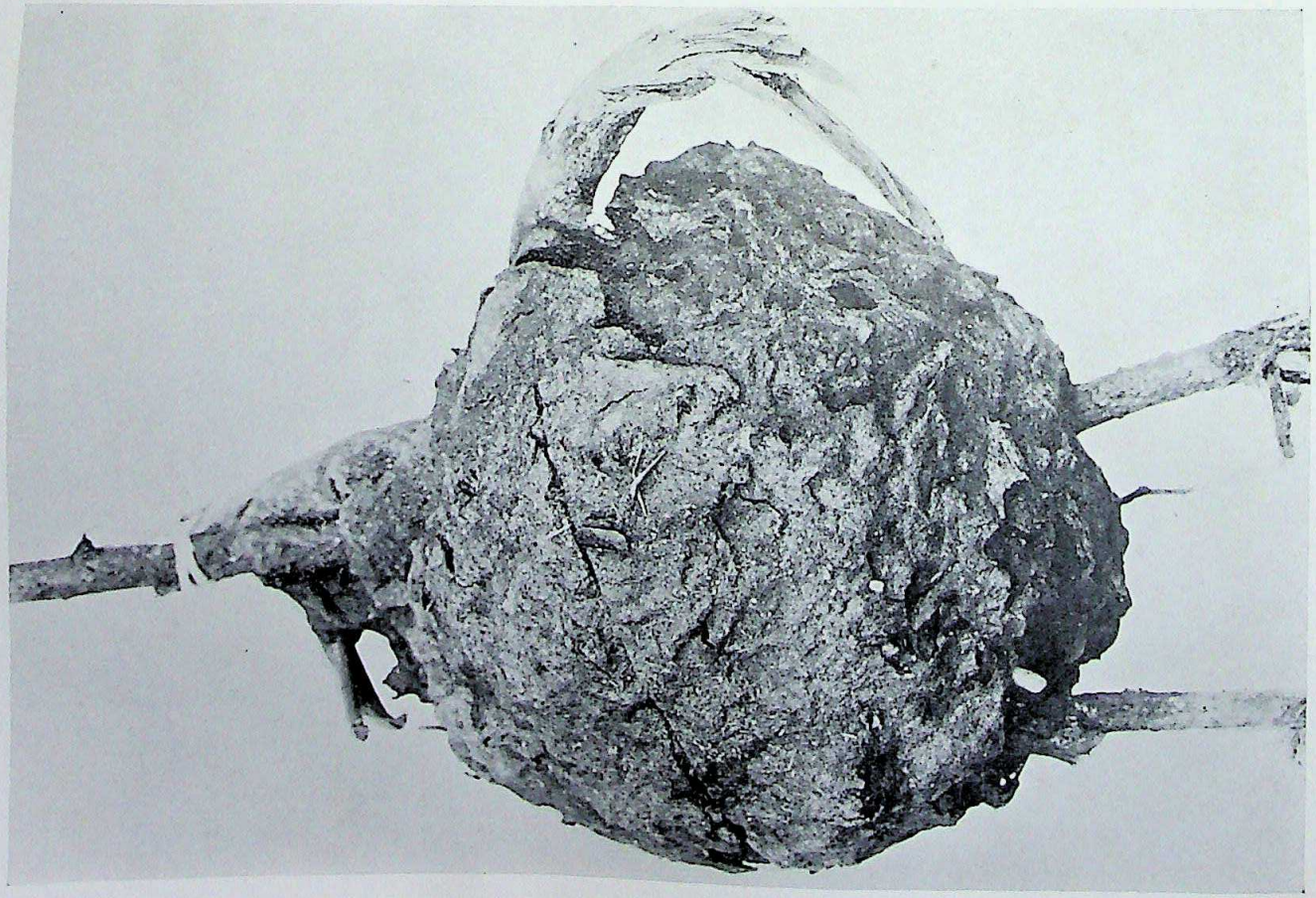

Fig. 1.—Carton nest of *Crematogaster dohrni artifex*, Mayr.

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semicircular, but present no regularity in size or shape. They vary in size with a width and height ranging from 3 to 8 mm. and are big enough to allow the passage of half a dozen workers as also the winged sexual forms. The outer sheet or covering may not be entirely continuous and unbroken all round the spherical body of the nest. The upper portions may have a stronger and thicker covering due to the presence of more than one layer of convex sheets extending irregularly down the surface. The convex elevations and apertures are generally less numerous on the upper surfaces. This covering is nearly as efficient as the rest of the nest both in durability and hardness. On making a slight breach in the outer envelope, the interior of the nest is seen to present somewhat the appearance of a large sponge built out of several layers of leaf-like sheets. These convex sheets are arranged one over the other with interspaces enclosing a comb-like mass of passages and a labyrinth of covered ways leading in different directions. This arrangement may be compared to the irregular old-fashioned piling of heaps of tiles on the roofs of Indian houses.

Internal architecture.—A vertical or transverse section carefully cut through the nest by means of a fine small saw will reveal the nature of its internal structure (Photograph Fig. 3). The interior is seen crowded with irregular anastomosing galleries comprising small halls and corridors varying from 2 to 9 mm. in diameter. They lead in different directions and are formed by side walls and partitions built of the same material as the nest disposed in thin layers. Not infrequently a whole or portion of a dried leaf is taken advantage of to assist in making this labyrinth of chambers. Occasionally such leaves are covered or coated with this papery material. These galleries and chambers are the abodes of the members of the community and the nurseries of their brood wherein all functions and activities of the community are carried out. From an examination of a number of nests and their internal chambers it would appear that there are no separate specialised chambers for the different categories or castes of the colony. But this much can be ascertained, generally the eggs and young larvae are distributed more towards the inner recesses and the pupae and the teneral adults are located near the outer chambers, passages and halls. The winged males are also met with in chambers near the periphery of the nest. The queens and workers throng the interior of the entire nest. No specially enlarged cells or chambers, set apart for queens, were noticed. In these and other respects the mode of architecture and allocation of quarters differ from certain other groups of social insects like bees or termites.

Nest material.—The 'carton' manufactured by the ants for building their nests is a combination of several substances. A variety of raw material is used in the making. Wood scrapings, dust, fibre, leaf particles, scraps of bark, a little earth, and grains of sand all apparently go into its composition. The sharp mandibles and other mouth parts of the ants are the machinery employed in its manufacture. The raw material is chewed and

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with the help of a secretion from the salivary glands worked up into a kind of paste; probably faecal and proctodial matter are also employed in the mixture. Thus is produced the woody composition, sufficiently hard and strong when dry, with which the nests are built. It is a hard compact material, which though somewhat brittle, yet retains some flexibility which it owes probably to the glandular secretions which enter into its composition. On the whole the 'carton' is more or less proof against rough weather. The nests withstand the rain though the outer layers become softened. That these nests are weatherproof was fully demonstrated by the nests experimentally grafted on to trees in the College grounds where they were exposed to the full force of the monsoon. The inhabitants equally survived the complete immersion of their nests in water.

The 'carton' has been subjected to a process of chemical analysis[1] and the following account may provide additional data as to its composition:—

1. Moisture	10·00
Dry basis	
2. Loss on ignition—organic matter	81·20
3. Insoluble mineral	2·77
4. Soluble mineral matter by difference	16·03
Total ...	100·00

Qualitative tests carried out with an hydrochloric acid extract indicated the presence of the following acids and bases among others:—

1. Phosphoric acid (P_2O_5.)
2. Sulphuric acid (SO_3).
3. Iron and Alumina ($Al_2O_3 + F_2O_3$)
4. Lime (CaO).
5. Potash (K_2O).

About 80·1 of the total dry matter of the nest consists of organic matter and it is probable that very nearly the whole of it is derived from plant materials such as leaves, twigs, bark etc. About 80·85 per cent. of the total mineral matter is acid soluble and the rest comprises insoluble sand. The fact that sand forms such a small fraction of the total mineral matter may suggest that the minerals are all derived from vegetable matter alone and no earth as such enters into the composition of the nest material. The material is strong, tough and hard and is insoluble in water.

The flakes comprising the material of the nest are hard, firm and strong though brittle. The material from which they are built appears to be impervious to water vapour or even to water. Two pieces of carton taken from a nest were placed in test tubes where one flake was brought into direct contact with the water and the other suspended above it so that the aqueous vapour might affect it. At the end of 24 hours there was no appreciable change in the weight of the flake suspended above the water while the flake brought into direct contact with the water showed a very slight loss. The experiment indicates a high degree of compactness and the absence of porosity in the carton despite its apparent thinness. The waterproof condition of the carton may arise from a coating of the glandular secretion applied by the ants over its surface and the secretion thus forms a cement-like coating which protects the nest during the continuous rains of the monsoon.

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[1] The writer is indebted to Mr. Varahalu, Assistant to the Agricultural Chemist, for the chemical analysis and his thanks are herein recorded.

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Tests with the following reagents on the flakes as also on powdered material were conducted:—

1. Dilute caustic potash—decinormal solution.
2. Dilute sulphuric acid—decinormal solution.
3. Water (hot and cold).
4. Sulphuric ether—decinormal solution.
5. Ethyl alcohol (98 per cent.).
6. Chloroform.
7. Carbon disulphide.
8. Acetone.
9. Benzol.
10. Nitrobenzene.
11. Pyridine.

After continuous shaking, these were kept overnight. They were filtered subsequently and the residues left over after evaporating the filtrates showed the presence of (1) vegetable colouring matter, (2) fats and waxes. Of the numerous solvents tried, pyridine extracted the largest amount of these substances from the material. This was highly resinous and extremely sticky. While shaking with pyridine, the material gradually tended to disintegrate and soften. It lost its original firmness. No such changes were however observable in the case of the other solvents. This points to the fact that the cementing secretion of the material is pyridine soluble. Neither dilute sulphuric acid nor water, hot or cold, softened the material. It retained its firmness even after 48 hours of soaking. Caustic alkali caused (1) the swelling of the material and (2) the gradual dissolution of it.

Construction.—The actual process of nest construction has not been observed. The workers, after selecting a suitable building site on a branch, probably spread the paste-like material in thin layers and so gradually build up their globular nests. The labour involved appears formidable but the industry and co-operation of myriads of workers finally produce a structure which cannot but rouse our admiration. Together they collect the raw substances and by their combined industry produce the most efficient non-conducting building material which is proof against the elements, and with this product they build themselves an edifice which is both a fortress and a home—suited to all their requirements.

Trees infested.—These exclusive tree-dwellers seem to be partial to a few trees commonly occurring in these hills as may be gathered from the statement furnished below. Among these the *Valichai* tree appears to be a particular favourite as may be inferred from the number of nests occurring on it as also from the maximum size these attain.

Scientific name	Vernacular name	Locality	Remarks
Gardenia lucida Roxb.	Valichai ...	Serumalai ...	Nest fairly common on branches, largest sized
Aphania bifoliata Radlk.	Kookaimuthu ...	,,	Less common
Ochna squarrosa Linn.	Chilandi ...	,,	Occasionally found
Ixora parviflora Vahl.	Kurachushundu.	,,	

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Other Known Carton-Builders.

Suspended carton nests are known to be built, according to Wheeler, by many species of ants all over the world and these mainly belong to the genera *Camponotus, Polyrhachis, Azctica, Dolichoderes, Crematogaster, Macronischa, Myrmecaria* and *Tetramorium*. Among these the genus *Crematogaster* includes the largest number of carton-building species.

Name of species	Locality	Authority
C. ravavalonæ	Madagascar island	Forel.
C. tricolor	,,	,,
C. schencki	,,	,,
C. inconspicua	Africa	Mayr.
C. marginata		
C. stadelmanni		
C opaciceps		
C. hova		
C. peringueyi		Smith
C. montezumia		
C sulcata	Tropical America	Forel
C. ramulinida		
C. sholli		
C. lincolata		

In India the only species so far noted to be carton-builders are *C. kerbyi, C. rogenhoferi* and *C. ebeninus* referred to by Rothney, Wroughton and Mayr. The species of ant under discussion *C. artifex* has been recorded as a carton-builder in Siam and Singapore by Mayr. The writer has not come across any record of this species from S. India.

Crematogaster dohrni artifex, Mayr.

The species concerned is *Crematogaster* (*Acrocoelia*) *dohrni artifex* Mayr. It belongs to the sub-family *Myrmecinae*, tribe—*Crematogastrini*, genus—*Crematogaster*, sub-genus—*Acrocoelia*, species—*dohrni* Mayr., sub-species—*artifex* Mayr., *Verh. Zool.-Bot. G.E.S. Wien*, vol. xxviii, p. 682 (1878).

Distribution.—This appears to be the first record of its occurrence in S. India and probably in India. As stated already the species has been recorded by Mayr. as occurring in Siam and Singapore.

The genus *Crematogaster* is a large one and comprises a number of species which are distributed over the whole of the warmer parts of the entire world. They possess the most varied habits. Some five species have been noted by the writer in S. India as common—*C. rothneyi, C. contempta, C. subnuda, C. antherina*. But all these are quite different from the species under discussion particularly in their life economy and nesting habits. The species *C. rothneyi* is a near ally of *C. artifex* in structure and size, but entirely different in its nesting habits. The former

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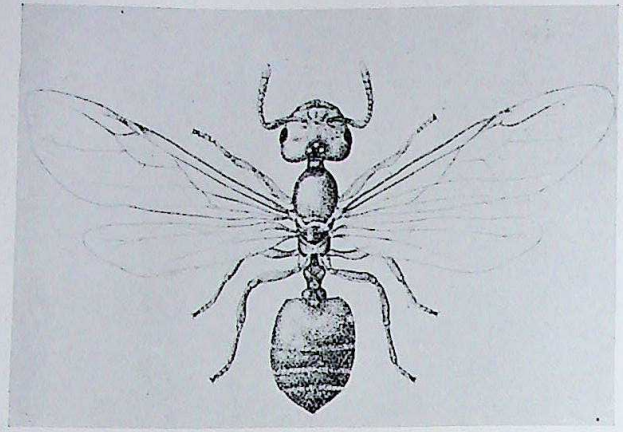

Fig. 1.—Queen.

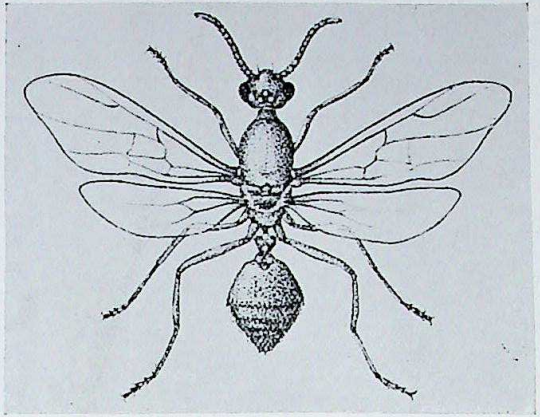

Fig. 2.—Male.

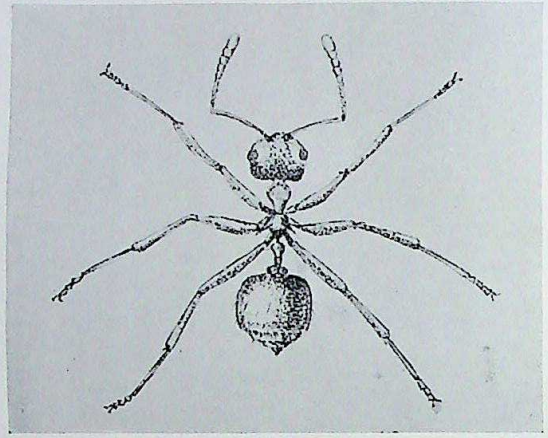

Fig. 3.—Worker major.

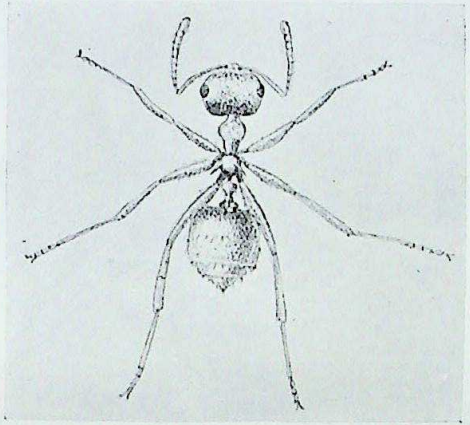

Fig. 4.—Worker minor.

Crematogaster dohrni artifex, Mayr.

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occurs in houses, gardens, plants and in a variety of other situations; but the nests are always found in the soil or in crevices in the walls of buildings at a depth of 3 or 4 in.

Members of the Community.

There are three distinct types or castes of individuals in the colony: (1) the *females* or *queens*, (2) the *males*, and (3) the *workers* along with the immature forms, i.e., the larvae and pupae of each of these. The three adult castes differ much in size, structure and habits. The workers consist of two types—the worker major and the worker minor. The workers possess no noticeable difference either in structure or habits, but show a slight variation in regard to size.

The Queen (Pl. II, fig. 1).

There are two forms: the winged females and the dealated ones; but the latter are rather rare as the wings are retained during the greater part of their lives. The female is a well-developed robust individual and is comparatively much larger than the males or workers.

Length 8·5 mm. to 9·2 mm. with ovipositor extended; width in abdomen 2·5 mm. to 2·75 mm.; wing expanse 1·55 mm. to 1·62 mm. The general colour of the female is similar to that of worker, being dark yellowish brown with dorsal aspec of head and thorav fuscous. The ocelli are clear and transparent. The abdomen is large and massive and is deep dark brown towards apex. The ovipositor is just visible and not inconspicuous.

Head.—deep dull yellow—shining occiput—high—rounded slightly less broad than anterior margin. *Antennae.*—moderately thick covered with short soft hairs 11-jointed—scape gradually broadening towards end. *Flagellum.*—gradually thickened to apex with a distinct club of three terminal segments. *Eyes.*—dark, placed about middle on the sides of head. *Ocelli.*—distinct, transparent. *Mouth parts* (figure).—comparatively large. *Clypeus.*—broad with anterior margin very nearly straight. *Mandibles.*—thick and stout, shorter than those of ♀, possess 5 teeth not so pointed as in ☿—the apical one longer than rest folding closely into head with outer margins visible. *Maxillary and labial palps.*—shorter and often thinner than of ☿. *Thorax.*—Pronotum more or less depressed beneath large convex mesonotum which overhangs the prothorax anteriorly but not completely. *Metanotum.*—oblique with a pair of very short stout thick spines—just visible—tips of spines dark. *Pedicel.*—not long—first joint broadened with rounded spines, concave from side to side and anteriorly, transparent yellow, second joint dark yellow with a narrower squamiform node rounded above. *Abdomen.*—much larger than that of ☿. Sub-cordate darkening towards apex, ovipositor just visible. *Wings.*—hyaline, cells indicated by yellowish nervures.

The number of queens present in a healthy active normal colony may vary within considerable limits. The number is comparatively high even in normal times. As many as fifty-nine winged females have been recovered from a colony. Queens are continuously developed probably in all months of the year, as was seen from nests kept under observation for nearly eight months. But the highest emergence takes place in April. On emergence the queens frequently wandered out of the nest in search of food and fed on the honey or jaggery syrup provided for them. From several trials it was found that the reproductive

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capacity of each female seems to be limited and is generally considerably less than in most of the other species. This notwithstanding, the community is one of the most populous. This has to be accounted for more by the multiplicity of queens than the individual rate of oviposition. Under artificial conditions, the winged female on emergence or after did not exhibit any great tendency to flight. In nature this may be different. But it is inferred from their habits in captivity, that the marriage flight itself takes place within the vicinity of the nest, and the majority of queens probably return after fecundation to the parent nest. That fertilisation can take place outside the nest is made clear from the fact that such females have been seen to produce fertile eggs. The winged females attended by workers frequently emerge from the nests during cool morning hours and also in the evenings. This tendency was markedly observed in certain cages in the laboratory in which the exits were not well secured thus permitting one or two queens accompanied by workers to escape and wander about. Like the workers the queens are impatient of drought and move from one side of the cage to another or to a wet sponge for the sake of moisture.

Food.—A queen can attend to her toilet without the assistance of the workers but rarely seeks her own food when in their company. When solitary she has been observed partaking of liquid food in the shape of honey or sugar syrup, as also to attack and catch a soft-bodied quiet termite nymph. When in the company of workers a queen is fed by her attendants, the process of feeding is effected by a mutual application of the mouth parts. She exhibits another striking tendency. She apparently is fond of proctodial matter exuded by the workers. She forcibly holds the gaster of a worker with her front legs and applies her mouth parts to the tip, the while gently stroking the abdomen with her antennae tickling the creature to induce the flow of the liquid coming out of the anus. This is rather a common proceeding among ants and in the present instance appears to be a modification of the habit of milking 'ant cattle'.

Behaviour.—Though several queens were kept together in separate cages or in slices of nests with and without a retinue of workers there was a complete absence of any hostility. They lived together in peace and amity, often congregating together huddled up in a family circle. Even queens from different nests were not antagonistic. But it was frequently observed that workers of a particular nest never tolerated the presence of an alien queen. Such intruding queens were mercilessly attacked and killed.

Fecundity.—In the queens fecundity appears to be comparatively low. To test their egg-laying capacity several queens were isolated in artificial cages, with or without workers. They were provided with sufficient moisture and food in the shape of honey or sugar syrup. Eggs were never laid till after six or seven days after emergence. The maximum number laid by a single queen per day never exceeded 3 or 4. In about a dozen observed cases the total number of eggs laid by a single individual never

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exceeded 21. A few queens were dissected under a binocular microscope seven days after emergence to gain some idea of individual egg-laying capacity. The number of eggs in various stages of development in the ovaries was found to be fairly constant for three individuals so tested. It varied from 42 to 46 averaging 44. When unattended by workers the queens collected eggs if scattered and shifted them from place to place often under or over a wet sponge; but such eggs fail to hatch in the absence of workers.

Founding new colonies.—It may have been apparent from the description of the nests and the elaboration of the material for their construction that the queens, though large-sized, may not by themselves be able to establish new colonies. The ordinary mode of founding a nest is probably by a process similar to 'swarming' in the case of honey bees, i.e., a certain contingent of workers headed by a queen or a number of queens may leave the parent colony and emigrate to new and suitable places to establish a separate colony. That this may be the usual method is strongly suggested by the continual marchings of an army of workers presided over by two or three queens after escaping through cloth coverings from artificial cages in the laboratory.

Longevity.—The longevity of the queens in isolation or in company with workers was tested in several cases. In each instance a plentiful supply of food in the shape of termites or maggots and honey or sugar syrup was provided. The maximum life span under these conditions never exceeded 58 days in April (9th April 1935 to 5th June 1935). The queens generally retain wings either throughout life or at least for 30 to 35 days. In rare cases the wings were pulled off by workers earlier.

Males (Pl. II, fig. 2).

These are feeble insects, slender, delicate and winged. They are much smaller than the workers. Length 3·5-3·75 mm.; width 1·0 mm. across thorax (the broadest part of body).

The whole body is covered with smooth erect hairs. The general colour is dull yellowish brown. Head smaller and a shade darker than thorax, with large and prominent eyes placed high on sides of head. Ocelli clear and transparent. *Antennae* 12-jointed; scape very short. *Flagellum* without club, the last joint much longer than the rest, first joint rounded in form (globose). *Mouth parts* (fig.) delicate. *Mandibles* slightly rounded below—conical—and more or less tapering. *Apex* with a minute cleft. *Maxillae* and *labium* comparatively larger. *Thorax* very similar to ♀ but completely devoid of spines and legs are very delicate. *Pedicel* more or less similar to ♀, second joint transversely oval. *Abdomen* of a deeper yellow brown, abdominal tip not pointed as in ♀. Genitalia present and visible and well defined (fig.) consisting of the usual parts. *Wings* hyaline but not as glassy as in ♀. Nervures yellowish.

The males on emergence are not active. They are often dragged about and harassed by the workers, who sometimes forcibly pull off the wings and carry them about between their mandibles. The males are often attacked by ectoparasites in the form of small mites.

Longevity.—The males are shortlived and have not been observed to imbibe any food. Maximum period of life observed in cages is 11 days.

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Workers (Pl. II, figs. 3 & 4).

Description.—The workers are of two types, worker major and worker minor. These are structurally more or less identical with slight differences in size of head, thorax, antennae but the main difference is only in size.

☿ major 4·10-5·11 mm.; ☿ minor 3·25-3·82 mm.

The larger workers are at least twice as numerous as the smaller ones. Both the forms are equally active and industrious sharing and attending to the duties of the colony.

The worker is a dark reddish brown insect with the abdomen varying from dark to dark brown. The body is very nearly covered with whitish hairs fairly long. The head is approximately square in shape with an indistinct trace of fine longitudinal striations.

Mouth parts.—Mandible long with five sharp teeth; maxillary and labial palps somewhat longer than those of ♀♀ or ♂♂. The worker major has a slightly broader head than the minor. Antennae distinctly clubbed at the tip. Eyes placed at sides of head. *Thorax.*—The metanotum is rather broad with long pointed divergent spines directed backwards. Abdomen flat and broad with the sting conspicuous. Stylets sharp tapering and very fine at the tip.

Longevity.—Workers are comparatively shortlived. They lived on an average for about 5 to 6 weeks in captivity. The maximum period noted in isolated cages was about 7 weeks.

Immature Stages and Larval Anatomy.

Oviposition.—Several queens were isolated in cages for recording their egg-laying capacity with and without workers. Eggs were laid by queens even when unattended by workers. Hence it is inferred that no special oviposition stimulus is derived from the presence of workers; but the eggs invariably fail to hatch in their absence. The queen takes some care of the eggs but even then they get mouldy. Eggs were laid singly, and were glued on to glass surfaces, corks or even cloth plugs. The number laid by an individual per day is generally 3, but occasionally 4 may be found. Egg-laying was never observed earlier than at least 7 days after emergence. The maximum number laid never exceeded 21 by any single individual in artificial cages; but it varied from 18 to 21 in the month of April for 11 individuals under observation. The queen continues to lay eggs for 6 or 7 days with irregular breaks.

The egg.—It is nearly white in colour, elliptical, slightly thickened in the middle; ends obtuse rounded, one end a shade narrower. The surface is lustrous indistinctly shagreened under high-power microscope. Chorion—elastic with no markings other than a longitudinal white streak (Pl. III, fig. 1).

Length 0·46-0·52 mm. average being 0·47 mm. for 40 specimens. Average thickness in middle region 0·27 mm.; broad rounded end 0·27 mm.; other end 0·255 mm.

Incubation period.—The incubation periods of the eggs in artificial cages with queens and workers were noted for quite a large number during April and May 1935. The incubation period varies considerably if the cages are not provided with sufficient moisture to make conditions of incubation entirely favourable; but

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Egg

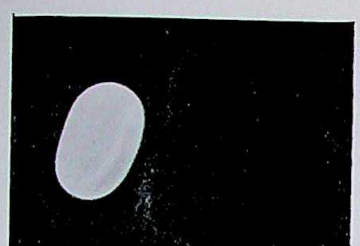

Fig. 1.—Egg.

Larvae

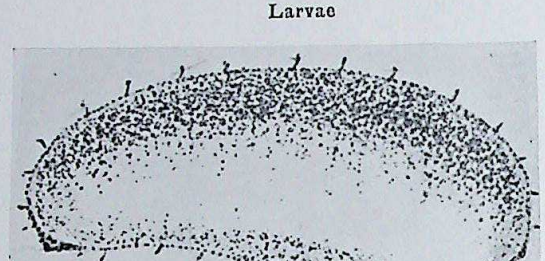

Fig. 2.—Queen larva (fullgrown).

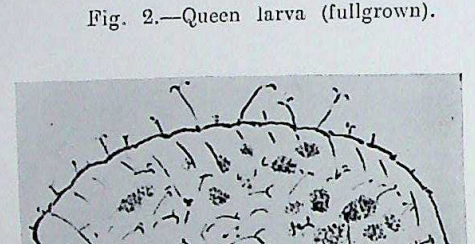

Fig. 3.—Worker larva (fullgrown).

Pupae

Fig. 4.—Queen Pupa.

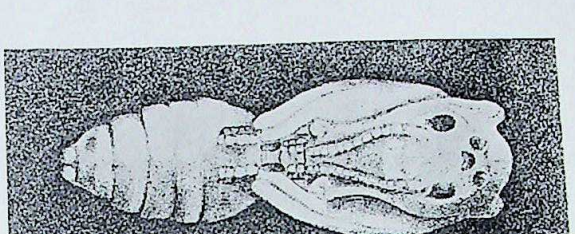

Fig. 5.—Male Pupa.

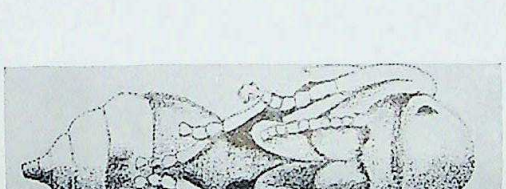

Fig. 6.—Worker Pupa.

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it is generally short, about four or five days. The eggs seem to show a state of growth just before hatching. Towards the beginning of the third or the fourth day colour slightly fades, but not very perceptibly. The egg now assumes a dull creamy tinge and the larvae may be discernible through the thin chorion under the microscope.

Larva.—Upon hatching the larva is hardly larger than the egg and remains curved for a short while. It closely resembles the larvae of other species of the genus and has much in common with the grubs of the family. As is usual with the family, the grubs are soft apodous, vermiform, glassy covered by a transparent membrane having a small conical projection marking the narrower anterior end and slightly broader approximately straight hind end. The usual 13 segments are not clearly marked at this stage. Like other larvae they are incapable of exertion. They possess a sparse covering of small rigid hairs projecting from minute tubercles or elevations on the integument, which are helpful for providing easy transport. Some of these hairs show a tendency to be tipped or incipiently forked (Pl. III, fig. 3).

The young larvae are fed by the workers on liquid disgorged food and the diet of the older ones probably includes bits of solid substances in addition. In cages provided only with vegetable food, grain, syrup, etc., the development of the larvae appeared to be slow and delayed. The quantity and the quality of the food effect changes and produce irregular growth in the larvae. After the fourth or fifth day it is easy to tell a queen grub from a worker one by the size and growth (Pl. III, fig. 2).

The older worker larva.—Length 1.05 mm.; width 0.64 mm. These worker grubs at this stage are covered with different kinds of hairs which can be classified under five distinct kinds. Some hairs are simple. Others are tipped; still others are forked. The majority are furcate or tipped with a double hook so that they look like miniature anchors. A few are imperfectly anchor-shaped. The hairs are about 1/20th of the width of the larvae.

The full-grown worker larva possesses only a few scattered hairs. Length 2.60-2.75 mm.; width 1.0 mm.

The queen larva.—The full-grown queen larva is much stouter and longer in size and is dull creamy white in colour. It is almost smooth save for sparse minute hairs. Length 4.9-5.2 mm.; width 2.2-2.5 mm. The mass of meconium is only indistinctly visible in these grubs (Pl. III, fig. 2).

The grubs of males have not been identified as such by the writer.

Pupa.—When full grown the larva discharges as usual the meconium and passes on to semi-pupa stage. Unlike the larvae of *Camponotus* these grubs transform themselves into pupae without a cocoon. The pupae are naked and in this stage the various castes including worker major and minor are easily distinguished by size, appearance and colour.

The queen pupae (Pl. III, fig. 4) are dull creamy white in colour and are comparatively in size. Length 7.1-7.4 mm.; width 2.1-2.3 mm.

Fig. 3.—Worker larva (fullgrown).

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The male pupae (Pl. III, fig. 5) are a little shorter than those of the workers; but more robust at the thorax with developing wings. They are easily distinguished from worker pupae not only by colour, size and the presence of wings; but also by the distinct visibility of three ocelli and pinkish eyes. Length 2.9-3.2 mm.; width 1.21-1.35 mm.

The worker pupae (Pl. III, fig. 6) are dull dirty white, sometimes greyish white to slight brown in colour. Length 3.6-3.75 mm.; width 1.1-1.20 mm.

The worker, queen and male pupae are in the earliest stage whitish in colour and devoid of any markings except the reddish eye spots. As they develop they assume a shade of brownish yellow which gradually deepens. They are devoid of any cocoon and the thin fragile pupal skins are shed when the callow emerges. These pupal skins are seen to be easily disposed of by workers, probably devoured.

The Callows.—The callows or newly-hatched workers are yellowish white which changes to medium brownish yellow and soon after to brown or dark brown. They take a little over two days to assume the adult colouration. The helpless callows are not entirely idle during the period. They are not strong enough to undertake the labours of foraging or defence; but the instinctive obsession of nurture of the brood is displayed by them. Some time after emergence, they have been seen to shift the eggs and larvae as also to constantly lick them with their soft mouth parts.

Length of Life Cycle and Developmental Periods.

The total period of the life cycle varies very much not only in the different castes but also in the same caste according to conditions of temperature, humidity and food supply. Several experiments in artificial cages were conducted to gauge the period of the egg, larval and pupal stages and a regular and systematic observation of about six complete nests was continued in the laboratory for nearly eight months. From four to five broods were reared in the nests beginning from the middle of January. The one essential condition was to keep one or several queens and a number of workers along with the eggs and larvae as otherwise the eggs fail to hatch and the larvae do not mature. Another factor equally important is to provide as nearly natural conditions as possible including the quality and the quantity of food supplied. Several separate trials of isolation of a known number of workers with a queen or two introduced in a small slice of an empty and cleaned nest were carried out and the total minimum period for the emergence of a fresh brood of workers was noted. Since the development period of the larvae is difficult to determine separately, the length of egg stage and pupal stage were separately worked out. In one case eggs were laid on 16th April 1935 and the first emergence of callows was noted on 24th May 1935 and continued up to 26th

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June 1935. Thus the period varied in April and May from 38 days to 71 days.

Egg period noted—4 to 5 days.
Pupal period—10 to 21 days.
Larval period—24 to 47 days.

The minimum pupal period of queens has been noted to be 10 to 11 days; but it is almost certain from observation in nests kept in the laboratory that the length of the life cycle is much shorter in nature. It may be even a little less than a month.

Seasonal Variation and Swarming Period.

The study and observations of these ants were confined to a period of nearly eight months commencing from January 1935; and hence the account of their seasonal activity is restricted to results obtained during this limited period.

The colonies were noted to be most populous from March to May when the sexual winged forms as well as the workers are found in incalculable numbers. It may be inferred from the presence of a varying number of queens or females at all times, that the females are probably developed in small numbers all through the various seasons of the year as also the worker individuals. From about the middle of March small numbers of winged males begin to emerge and by about the middle of the next month thousands of males are produced. Thereafter there is a slow and gradual decline in numbers till about the beginning of May. From this period males are seen only rarely and in small numbers. Towards the end of March the numbers of winged females begin to show an increase attaining a maximum by about the middle of April. They continue to emerge for about a week. This period, i.e., the end of April appears to mark the peak of emergence and hence the real swarming season and the period of marriage flights are confined largely to this part of the year. From the beginning of May till early June the number of queens produced gradually decreases. Soon after the appearance of queens the production of workers is hastened and the largest numbers are found in May and the beginning of June. After the middle of June the numbers undergo a gradual diminution so that only the normal activities are continued. By about the end of July considerable numbers die and the colony has a precarious existence under artificial conditions. It has been seen that the males put in their appearance early in the field, i.e., about two weeks before the swarming of queens. It is inferred that the queens naturally require a longer period of development than males.

Sex Ratio.

It is difficult to estimate the sex ratio with any accuracy as the winged sexual forms continue to emerge day after day during the swarming season and long after. In order to arrive at some idea of the proportion of the sexes a few swarms of males and females that emerged out of the nests on particular days in the

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zenith of the swarming season were collected and a few such computations were actually made. The percentage of winged females varied slightly, but was never seen to exceed 3 per cent. of the emerged sexual forms.

Habits in General.

These ants are markedly carnivorous and depend mainly on animal food for their sustenance though they exhibit a partiality for any sweet liquid such as honey or syrup. They were reared for months in the laboratory on a supply of termites or soft fleshy maggots, hairless caterpillars, the flesh diet being varied with an occasional provision of jaggery syrup or honey. Soft bodied insects like termites are their main prey though they will attack small beetles and flies. Their chief weapons of attack are their sharp mandibles. It is said on excellent authority that the sting is rarely used by ants of this genus but the writer's experience to the contrary is based on long and continuous observation in the laboratory. The ants attacked insects introduced into their cages with their sharp and powerful mandibles but if resistance was offered the sting was freely used. The sting is thrust direct into the body of the victim by turning the tip of the mobile gaster or the ant in the accustomed manner elevates its abdomen above its back or head and squirts the acid into the wound made by its mandibles. Occasionally in the scuffle a turbulent termite would get hold of an ant by a leg or an antenna. In its efforts to free itself the ant would bring its sting repeatedly into play, sometimes it was helped by a passing comrade who coming to the rescue equally used its sting as the more effective weapon of attack. In the process of stinging the stylets pierce the soft body of the victim and a minute drop of frothy liquid is injected into the wound. The writer has had personal and intimate experience of the methods of these ants in attack, particularly when collecting their nests from the trees, when the ants dropped like rain upon him, entered his clothing and brought their stings and mandibles into continuous and painful use.

The ants carry their victims into their nest holding them between their mandibles. Foraging parties of workers will bring in live and dead insects of various kinds. They feed on all kinds of animal matter, including the dead of their own species, evincing a trait of cannibalism which is apparent in the spoils conveyed by the workers to their nests. Occasionally a few workers join hands in transporting a particularly heavy object to the nest. Such team work is rare in this species; but in one instance the captives in our laboratory gave a marvellous example of co-operation and team work. Their objective in this instance was some powdered jaggery heaped on a high glass cube in the proximity of the nest. Some of the workers succeeded in climbing the smooth walls of the cube, while the rest crowded round the bottom. The workers at the summit of the cube attacked the pile of sweet stuff, each ant taking a particle between its mandibles, carried it to the edge of the cube and now, instead of descending with their burdens down the slippery surface of the cube, the ants

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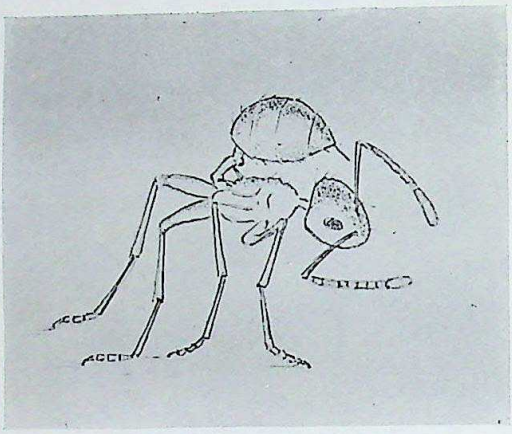

Fig. 1.—Worker ant with bent abdomen.

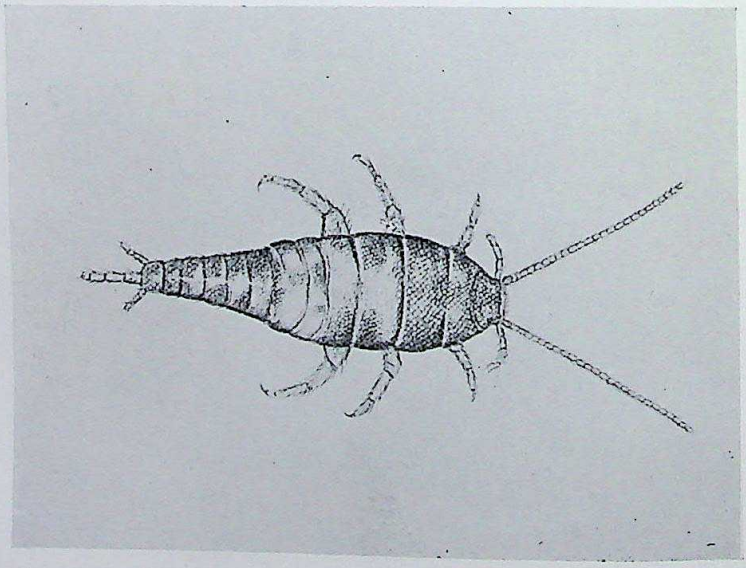

Fig. 2.—*Lepisma subnigrina cotygii* in nest of *Crematogaster d. artifex*.

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dropped the particles over the edge, then cleaning its antennae and mandibles each ant went back to the pile for more. They kept steadily at their labour till the pile of food was cleared and every particle of it dropped over the edge. The legion of workers below were not idle. They picked up the particles as they were dropped by the workers above and carried them in a continuous stream to the nest.

The partiality of this species for honey and syrup or sugary liquid has already been commented upon. An ounce or two of jaggery syrup or honey solution kept inside their cages was consumed in the short space of an hour. In the act of feeding they presented a beautiful sight, arranging themselves in a regular row round the brim of the shallow vessel, drinking with their mouth parts dipped into the liquid. When satiated they remained motionless and inactive. In addition, these ants like some other species imbibe 'honeydew' from various Aphids and Coccids. This pastoral habit of 'milking' different kinds of Homoptera for the supply of 'honeydew' is not as strongly developed in these as in some other ants. But when available the syrupy fluid given out by these insects is eagerly sought after, as was observed when the ants' nests were placed on trees infested with coccids or when the ants were supplied with leaves or twigs covered with these minute insects. In rapid movement particularly when excited or alarmed the workers hold the abdomen curved over the back (Pl. IV, fig. 1). It is a trait characteristic of the genus, though a closely allied species, *C. rothmeyi*, the commonest of the fraternity in South India seldom displays this peculiar gait. The action of holding the mobile gaster bent over the back is probably a defensive device—in this position the sting is held like a lance in rest ready for action—it is a warning of prompt attack. When disturbed, the workers swarm out of the nests in thousands and their movements *en masse* produce a characteristic rustling sound like the patter of light rain on dead leaves.

Their relations among themselves and with others of alien colonies.—The workers of the same colony do not show any great tendency to team work and co-operation except perhaps in the process of nesting and occasionally in the face of a common enemy when they seem to act together. In the course of their normal activities they often meet one another in their marches and have been observed to exchange greetings by antennal wavings and strokes. Sometimes two individuals will stand with their mouth parts interlocked for about half a minute to exchange food. One noticeable feature is their occasional behaviour towards the frail, helpless winged males. These latter were often dragged, pulled out, mangled and thrown out from the nests.

Hostility among workers of different nests.—Great antagonism is exhibited by workers of different nests. About half a dozen nests were kept under observation in the laboratory at a distance of two to three feet from one another. Not infrequently batches of workers escaped from cages through holes bitten through the thick cloth covering. They marched on the table in groups and

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naturally encountered similar battalions from neighbouring nests. On such occasions great battles ensued between the parties and clusters of struggling ants interlocked in mutual assault and piles of dead were seen between the cages on the table. The workers do not of course possess any striking odour, but what little odour they emitted was certainly disagreeable.

Battle with black ants.—In order to find out whether it would be possible to establish these ants on trees in the plains as also to study their habits outdoors a few nests obtained from the hills were kept under observation attached to branches of suitable trees on the college premises. One such was grafted on to a branch of a *Peltophorum* tree and another to a *Neem* tree. Within a few hours after introduction the ants began to stream out along branches in small numbers. In the cool of the morning or evening particularly, large swarms of workers sallied forth in continuous streams along different branches and, as the sun grew hotter, returned with spoils of diverse kinds to the nest. Except during the hottest part of the day they were busy with their normal duties such as foraging, milking ant cattle, etc. But soon they were faced with a formidable enemy in the shape of the common black ant (*Camponotus compressus*). The soldiers and workers of the giant ants began to attack them all along their routes and attempted to storm their fortress after their retreat into the nests. The black ants possess the advantage of bodily size and strength and a more powerful armature of mandibles; but they were more cumbrous and certainly less agile in movement. Any unwary crematogaster caught between the great mandibles of a black ant was immediately killed. The smaller ants valiantly defended their nests against the intruding enemy; but despite the courageous defence they put up theirs was a losing fight. They were no match for the giants in single hand to hand fighting. But they soon developed different tactics and attacked their antagonists by rushing out of the nest biting a leg or antenna and immediately retreating into the nest. As many as twenty or thirty ants would engage in this hit and run battle against one of the giants, who knew not how to defend himself. Thus by their agility and the weight of their numbers they were able to stem the attack. Thus they defended their nests for days. The battle field round the nest and branches and on the ground below was strewn with many dead and dying black ants literally covered with numerous dead and dying crematogasters firmly clinging to legs, antennae and other parts. The colonies continued to flourish for about a fortnight. They were apparently not much affected by the weather. The nests withstood some heavy April showers except that the outer portions were slightly softened. But the colonies soon dwindled, probably on account of climatic changes, but chiefly as the result of an increase in the number of the black ants—too strong an adversary for these small ants to resist indefinitely. Ultimately one of the colonies was wiped out, and the other removed to the laboratory for observation.

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Provisions in the Colony.—These ants do not keep any store of provisions in the nest. They appear to depend upon their daily labour for sustenance. Large quantities of the remains of termites and other used up food, mutilated wings, empty head capsules are sometimes found in the superficial compartments of their abodes. These are regularly cleared by workers from the nests. These ants have not been observed to keep any 'ant cattle' inside their habitations.

Guests in the Colony.—In almost all nests a good number of small dark-coloured Lepismids (Pl. IV, fig. 2) were commonly found. No other living creatures were noted associated with or living inside these curious nests. These small Lepismids were never seen in close communion with their hosts. They were observed gliding furtively through the galleries of the nests. The nature of their food or their precise relationship with their hosts have not been ascertained. The Lepismid is a dark insect with a broad thorax and tapering abdomen. *Size.*—Length 4.0 mm.; width at thorax 1.3 mm. They are very agile in their movements and highly elusive and therefore escape being caught. The specimens probably obtain their food from small droplets of sweetish liquids spilt during exchange of food by the ants. In their general appearance they have a close resemblance to the Lepisimid Atelura (Lepismina) recorded by Janet. The specimens have been identified by Dr. Silvestri as *Lepisma subnigrina* Silv. *cotygii.*[1] Are they Myrmecocleptics?

Census of the Community

The strength of the ant colony must greatly vary according to the supply of food. The colonies examined were invariably very populous. In order to obtain an idea of the population of a nest and to discover also the ratio of different castes, a nest from the branch of a tree was removed intact and enclosed with all its occupants in a long-cloth bag. The nest in question was a comparatively small one 7½ in. by 5½ in. in size. The entire nest in the bag was put in a closed glass jar and chloroform introduced. After a time it was found that the occupants of the innermost recesses were not killed. The nest was now cut up by a fine saw into four slices and its occupants were again chloroformed. The contents of the nest were later on emptied carefully and weighed and the numbers of individuals in sample weights were actually counted and the results are presented as below:—

Worker major including callows	39,082
Worker minor including callows	13,192
Males winged	4,614
Females winged	59
Female pupae	816
Female larvae large size	634
Eggs	37
Smallest larvae probably of ☿ and ♂	2,744
Pupae of ☿ and ♂	1,100

[1] My thanks are due to Dr. Silvestri for the identification of the specimen.

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Conclusion.

In the foregoing paragraphs an attempt has been made to present the life-economy, structure, life-history, relations, nesting architecture etc., of these wonderful ants. Their natural history on the whole constitutes one of the most fascinating and instructive chapters particularly in respect of animal instinct and ingenuity.

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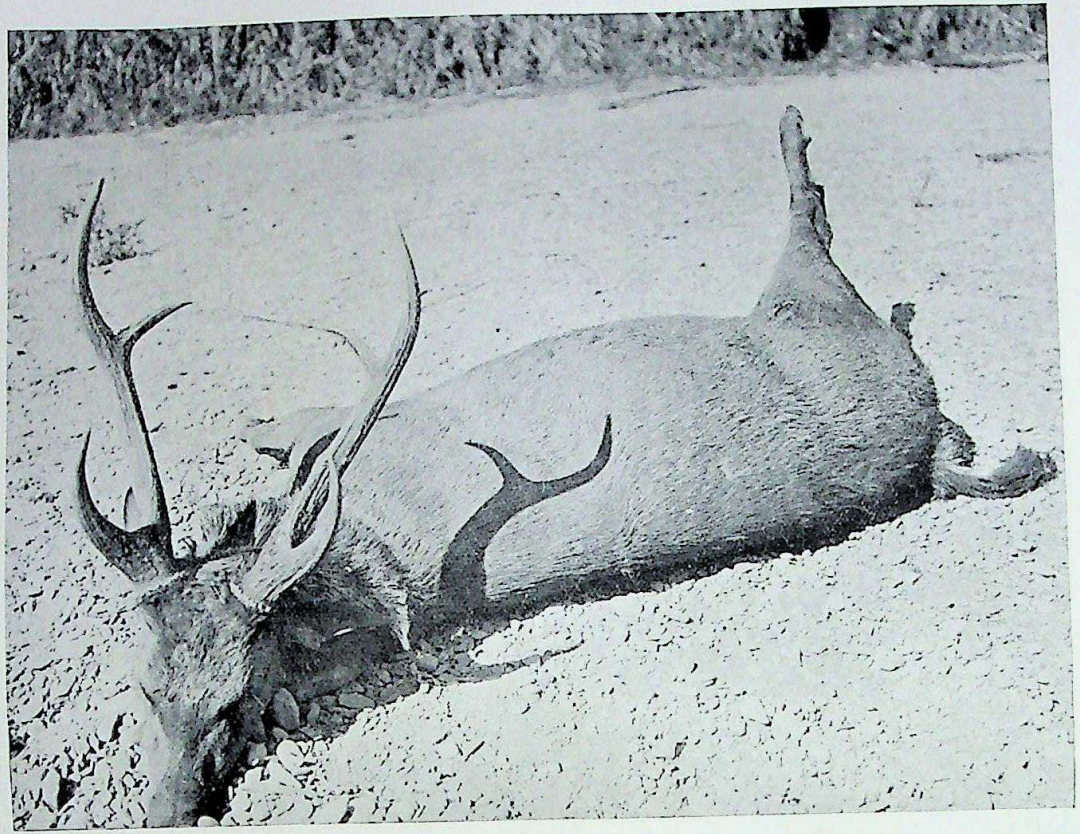

Malayan Sambar (*Rusa unicolor equinus*). *Photo by author.*

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THE MALAYAN OR BURMESE SAMBAR (*RUSA UNICOLOR EQUINUS*).

BY

W. S. THOM.

(*With a plate*).

The Sambar is described as the typical forest deer of South-Eastern Asia. Various races of this animal have been recognised within the wide area of its distribution. The typical form, the Indian Sambar (*Rusa unicolor unicolor*), ranges through India and Ceylon. It is the largest of all sambar and carries the finest horns. The Malay race, *Rusa unicolor equinus*, inhabits Assam, Burma and the Malay countries.

A Malay stag averages about 5 ft. in height, while a full-grown male weighs about 500 lbs. The horns of a mature Malayan sambar are set closer as a rule and average about 30 in. in length, but any horn over 35 in. is good. While the horns of the Malayan sambar are shorter than those of the Indian animal, they are massive and have a good if not greater average girth. The brow tine is usually much longer in proportion to the beam than is the case with the horns of Indian sambar. A heavy pair of antlers reaching 35-38 in. in length is a trophy worth having. The largest Malayan stag shot by me had a head of the following dimensions:—Length 42½ in., girth 9½ in., tip to tip 30 in.; widest inside 31 in., points 3 in. + 3 in. The head judging from the measurements given in the *Burma Game Manual* of the year 1929 is the record head for Burma. For India, the record is, I believe, the famous head from Bhopal which tapes 50⅞ in. So far as Burma is concerned, the best heads of deer, especially samabar, and of Bovines in general are to be found wherever there is a plentiful supply of food and water throughout the year and numerous salt-licks rich in bone and horn forming properties, together with a luxuriant growth of good grazing grass, undergrowth, evergreen tree and bamboo forest. Good feeding and horn and bone forming mineral salts seem to me to be material essential to the development of good heads. I am aware of course that in the dry zones of both India and Burma, where the pasturage cannot compare with what obtains in other parts of these countries, excellent heads are developed. But perhaps in these dry areas the absence of good grazing is compensated for by the presence of salt-licks rich in substance conducive to the growth of bone. My explanation may not be correct but I put it forward as a theory which may explain the prevalence of good heads in particular areas of the Sambar's distribution.

The average colour of the Malay Sambar is darker than the Indian species, approaching to black or slaty grey in old stags.

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The hair is coarse and long and forms a heavy ruff round the throat in mature stags.

Sambar are found pretty nearly all over Burma wherever there is sufficient cover for them. I have come upon them in every type of country, and at all elevations in both heavy or open bamboo and tree forest, in *khaing* or elephant grass, in thickets of wild plantain and evergreen *ponzoes* or deserted cultivation. Sambar are however never found in the open scrub jungle, usually frequented by Thamin i.e. Brow Antlered Deer (*R. thamin*).

Sambar are rarely found together in any numbers. Stags and hinds are often found singly, but small herds of from six to a dozen in number are commonly met with.

Sambar feed mainly at night and, as such, are described as nocturnal animals, but hinds and young stags come out to feed with systematic regularity in the late afternoons and do not usually seek cover till the sun is well up in the morning. Old stags are more seclusive in habit. They often occupy very inaccessible places during the day and lie up on the tops of precipitous rocky slopes, where a good breeze is available to keep off the flies. Or, they resort to well-wooded plateaus at the head of steep rocky streams, from whence they are able to command a good view of the surrounding country. A sambar makes hardly any movement and no sound when resting on the ground. The occasional flicker of an ear or a slight movement of the withers betray his presence only to the trained practised eye.

Sambar love wallowing in mud wallows, especially during the cold weather and frequently resort to dew ponds, pools and the beds of drying streams, or they frequent wallows excavated by pigs, elephants and rhinoceros. They also visit salt-licks at night. A habit to which they are more addicted, in my opinion, than any of the other large or smaller game in Burma.

The question as to how often sambar drink depends a good deal on season, temperature, climate and on the amount of water available in the area. An important factor is the extent to which the animals have been subject to harassment. According to some of my Burma hunters, sambar drink nightly, others incline to the belief that they drink only every second or third night. I believe that these animals can go without water for even longer periods if obliged to, but if undisturbed, they drink regularly. Thamin, on the other hand, though living in hot dry regions, are very abstemious as compared with other deer and do without water for long periods.

Sambar are perhaps the most alert of all animals found in the jungles of Burma, with the exception perhaps of the Tapir. Like other animals they seem to have a sixth sense. At the slightest sign of danger, a sambar is able, in the darkest night, to dash through the jungle, carrying his spreading antlers through the tangle of trees and covering the most dangerous and precipitous ground in its headlong stride.

Compared with bison or tsaing, the sambar lives in closer association with Man. Its most deadly enemy in the jungle is undoubtedly the Wild Dog. My experience with these vermin

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is that the victim is hamstrung and not emasculated as is generally supposed. I once had the unusual experience of coming upon a huge emasculated boar, covered with wounds, limping painfully along, surrounded by about 20 wild dogs. None of the dogs showed any signs of injury. I succeeded in shooting two of them with charges of buck shot and put an end to the misery of the boar who, champing her jaws to the last, made a gallant effort to get at me. I have heard sambar scream on several occasions at night when seized by wild dogs. A pack of wild dogs will take mouthfuls out of a sambar whilst the animal is alive. I have heard the same agonising cry of fear from a wounded sambar seized to have its throat cut or *halalled*. It is a heart-rending sound impelled by overwhelming fear. Fear, occasioned by the imminence of death, must be potent in its effect on such highly strung and sensitive animals as deer. I have seen two instances of very young sambar fawns dying from fright. In both instances my hunters captured fawns that had run into our party instead of bolting with their dams. There were no injuries of any description on either occasion, for I made a careful postmortem examination and, although I had no means of diagnosing the cause of their death, I could only assume that, as neither of the animals had been roughly treated, they had died of heart failure, induced by fright. In one case the animal died in my hunter's arms within a few feet of me after a very brief struggle.

The sambar's customary 'bell' is a familiar sound in the Indian jungle. Peacock in his *Game Book for Burma* says he has not heard in Burma the loud belling notes made by sambar stags when disturbed. It seems to me that he has been somewhat unfortunate in this respect, as I have often heard them bell loudly in various parts of Burma. A stag sambar in full horn will invariably utter these loud belling notes of alarm on scenting a tiger or when disturbed or when suspicious of some noise it has heard in the jungle and cannot fathom. Any sound out of the common —like the fall of a heavy branch from a tree will cause sambar to bell repeatedly. A sambar taken by surprise gallops off with a succession of leaps and bounds for some distance and then, as often as not, pulls up suddenly and turning round to face the danger makes the welkin ring with its 'belling', while it also stamps its feet from time to time. Which brings me to the subject of 'stamping grounds'.

Sambar have regular 'stamping grounds'. In open grounds as well as in the jungle, one often comes across these circular bare patches, devoid of all vegetation which have been stamped bare by the hooves of sambar. These stamping grounds may be anything from 10 to 40 feet in diameter. The smaller grounds I suspect, are the work of solitary stags. Do these stamping grounds serve any particular purpose? Why do sambar make them?

Fletcher in his book *Sport in the Nilgiris* states that he could never account for these clear circular spaces made by sambar always under an overhanging tree. He did not credit the explanation given by the local shikaris that they were 'swinging

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places' and that a stag hooked his fore legs over the overhanging branch and swung backwards and forwards, his hind legs trailing on the ground kicking the space clear. A stamping ground is not necessarily made under overhanging trees. The sambar being essentially a forest animal, it is natural that the majority of these 'clearings' are found under trees. But I have found such stamping grounds right out in the open where there were no trees or bushes in their immediate vicinity. 'Josh', Fletcher's tame sambar solved the riddle as to how these stamping grounds were made. Fletcher discovered one of these open patches under a tree close to his bungalow and, feeling sure it was 'Josh's' work, he watched him. A few mornings later he saw 'Josh' go to the tree and indulge in the most extraordinary antics. He pawed up the ground turning slowly round and round at the same time, and then stood straight upon his hind legs like a goat. This was repeated over and over again. Many a morning and evening afterwards, Fletcher saw 'Josh' going through the same gymnastics, but the animal's reason for doing so were not clear to him. He suggests that his sambar was working of a redundancy of animal spirits. All wild animals are blessed with an excess of vigour and spirits which takes expression in curious ways. Village cattle and wild cattle, for no apparent reason, will suddenly begin digging up the ground or a mound of earth with their hooves and horns. It may be, as Fletcher suggests, that these antics are an outlet for surplus energy, but why sambar select and adhere to a special site for their performances is a puzzle. It is well known that many animals have the habit of resorting to a particular spot for dropping their excreta. It is suggested that in social animals this habit may serve as a guide in keeping individuals of a herd together. The stamping grounds of sambar may serve a similar purpose and provide a sort of meeting ground, particularly during the mating season. Fletcher unfortunately does not mention the age of his tame sambar, nor tell us whether it was a stag or doe, or the time of the year when the animal carried out its antics. It is signficant that these stamping grounds are never seen in the rains, but are most in evidence in the beginning and through the cold weather, which coincides with the main breeding season of sambar. At this period, the majority of stags are in rut; they commence to challenge each other. Such a stag might well give vent to its feelings in rearing up and stamping. Its antics would then result in making one of these 'clearings' or 'stamping grounds' which may thus become a meeting ground for combats and a place for continuous resort. I once had the good fortune to witness a fight between a couple of stags, surrounded by about 8 or 10 does and immature males in one of these 'clearings'. The particular stamping ground was right out in the open or the top of a watershed in the Yomah hills, at an elevation of about 4,200 ft. There was no jungle anywhere within 200 yards of the scene and I came upon the animals in broad daylight—an unusual circumstance, as from my observation their meetings seem to occur more often on bright moonlight nights. Two stags of the herd were engaged pounding away at each

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other with their horns and hooves, frequently standing up on their hind leg as goats do when they fight. The clash of their horns as they met in mid air could be heard some way off. The stamping ground on which this encounter took place had a diameter of 30 ft.

During the pairing season old stags stalk about with erected tail, outstretched muzzle and everted face glands and are then by no means pleasant-looking animals. At this time, in captivity at any rate, they are highly dangerous. The period of gestation, as I have observed it in Burma, is about 8 months. Most of the fawns being dropped during the monsoon at the end of June or about the beginning of July. But to this rule there are exceptions for I have several times seen a hind with a newly born fawn at heel in the early spring in Burma.

As to the season of horn shedding, sambar are said by most sportsmen to shed their antlers annually from about May to July and to be in hard horn again in December. In Central and Southern India, the majority of stags are said to cast their horns between the end of March and mid-April. The horns commence to grow in May and are in velvet during the rains. Dunbar Brander, writing of sambar in his *Wild Animals of Central India*, says that he had never heard of sambar being in full horn in August or September. R. C. Morris records shooting a stag in full horn in September in the Billigrirangan Hills, S. India and Mr. H. G. M. Dunn, in the first week of September, shot a fine stag which had certainly been in full horn during the latter part of August. My record sambar head for Burma, referred to previously, was shot about the 20th of September. Fletcher in his *Sport in the Nilgiris* says that he has shot stags in perfect hard horn in July and August, when they ought to have been carrying undeveloped heads; whilst he once bagged a stag in velvet in December. Forsyth agrees that sambar do not shed their antlers annually. There appears to be then much variation both as to the pairing season in sambar and the time at which the antlers are shed. Both are perhaps interconnected since the ability of the stag to fight and gain possession of a harem of females would depend upon the conditions of his horns. Variation in the time at which horns are fully developed would imply variation in the seasons of breeding and a parallel variation in the time at which females are ready to breed. This annual shedding of the horns by deer is a remarkable phenomenon and it has often puzzled me why Nature should, in the case of the deer tribe alone, build up a huge bony structure only to destroy her handiwork every year and begin the whole process *de novo*.

Another matter which has been the subject of comment is the frequent prevalence on the throat of a peculiar bare and hairless patch, about 6 in. in diameter, usually referred to as 'Sore Neck in Sambar'. I will not go so far as to say that every wild sambar in Burma has this sore, because I, and other people whom I could name, have come across several animals without it. I have even been told that a similar sore has often been seen on the necks of thamin or brow-antlered deer (*Rucervus thamin*) and

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observed, in one instance at least, on the neck of a barking deer. Even sambar fawns are occasionally affected. Sambar bred in captivity, both does and stags, are however free from such disfigurement. Peacock in his book states that the animals are free from these sores in India, but this is not the case at all. Several writers in India have commented on it. The cause, according to some writers, is said to be due to the attack of some parasite, but, so far as is known, this parasite has not been satisfactorily isolated or identified. A note on the subject appeared in the *Journal* of the Natural History Society of Siam under the signature of Mr. P. R. Kemp, who was engaged on survey work. Mr. Kemp shot several sambar in Siam and during the months of December and June he observed that they were all affected by a peculiar sore situated in the middle line of the throat. The actual sore was about 1½ inches in diameter and the skin around it was devoid of hair which had apparently been rubbed off over an area about 8 inches long by 6 inches wide. The sore was superficial and did not extend deeply. Mr. Kemp states that this disease is recognized among the Siamese as the *Khi-Ruon-Kwang* or the leprosy of the sambar. It is believed to be due to the animals eating the fruit of the *Ma-Kawk* tree, a kind of wild plum generally known as the 'wild olive'. Mr. Kemp unfortunately does not give the botanical name of this wild 'plum' or 'olive'. The appearance of the sore in these animals is stated by the Siamese to synchronise with the time of the appearance of fruit on the *Ma-Kawk* trees. To take Mr. Kemp's theory, so far as my experience goes the only 'wild plums or olives', if one can call them such, which both sambar and barking deer eat in this country are the 'Gwethee' (*Spondias mangifera*) and the 'Zibyuthee' (*Phyllanthus emblica*). The people of this country eat a cultivated and larger variety of *Spondias mangifera* which is quite palatable. I have seen as many as 12 or 13 bleached stones of the latter fruit lying on the ground where sambar have rested, bringing up the stones from time to time and leaving them on the ground. If I have correctly identified the 'olive' or 'plum', referred to by Mr. Kemp as causing the disease among sambar in Siam, would not barking deer which also eat both these fruit develop the same disease?

The same disease has been observed by members of the Bombay Natural History Society in Assam and, it would be interesting to know if this has been the case in other parts of India. Mr. Dunbar Brander (see pp. 937 and 938 of vol. xxvii, No. 4 of 31-7-21 of the *Journal of the Bombay Natural History Society*) says, 'I was much interested in the notes regarding the mark or disease observed on the throats of sambar. I have several times observed the same thing on sambar in the United Provinces, always during the period that hair and horn were undergoing a change. At this period sambar do not come under much observation and I am inclined to think the wound is more common than is generally thought. The sore has always emanated from the centre of a whorl of hair on the throat and, as it has only been observed by me during the time the animal was changing coat

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or horn, I naturally connected the two and came to the conclusion that the sore or mark was the result of the changes taking place. I can only throw this out as a suggestion.'

I wrote to the officiating Director of Veterinary Services, Burma, Rangoon, Captain S. R. Rippon, in June 1935, about this subject and asked him to kindly go into the matter if possible and see whether he could not ascertain why these sores on sambar existed. He informed me that the Director Mr. Mitchell was then away on leave and that he would go into the question on his return in October 1935, as he, personally, had no opportunities of shooting any sambar. I have since heard from Mr. Mustill, Game Warden, Burma, that Mr. Mitchell has supplied him with some test tubes containing preservative and that he, Mr. Mustill, was going to collect some of the exudation from the sore of the next sambar he shoots so that Mr. Mitchell may be in a position to make an attempt to diagnose the disease, if disease it is. The wound always emanates from the centre of a whorl of hair on the throat, as stated by Mr. Dunbar Brander, but it should be indicated that there is, normally, very little hair on the portion of the throat where the sore appears. If the sore or circular patch on the sambar's neck is not the result of a parasite or a secretory gland such as is found on elephants, camels, black buck, etc., then it may be the result of bites by ticks and the intense irritation set up by the animals pushing their way through *khaing* or elephant grass, 'theke', and under growth. The sore is finally enlarged by the animals rubbing their necks for relief against every tree trunk and branch they come across, the enlargement of the wound causing more ticks to be finally attracted to the spot. It should not be forgotten also that there are several plants that cause the skin to itch like the devil, as for instance, a climber with yellowish coloured hairy beans or pods and besides at least two kinds of stinging nettles, not to speak of a horribly itchy plant with largish leaves known in Burma as the *petya*. Then again there are the fine hairs of the bamboo which also set up an irritation when brought in contact with the skin. It is many years since I shot a sambar, but so far as my memory serves me, these wounds or sores on the necks of sambar, which I first noticed in 1890, although red in appearance, hardly bleed at all and only exude a kind of whitish-looking oily or watery substance. When sambar push their way through grass and tick-infested jungle, especially during the cold weather, when ticks seem to be more plentiful than at any other time, the animals hold their heads well up and these insects then find the throat and neck the most convenient spot on which to gather. Could this be the cause of the sore? Captain Rippon in his letter to me says that the skin on the bare patch on the tame sambar's neck in the Rangoon Zoological Gardens appears to be quite normal, i.e. there were no signs of any parasitic disease to the naked eye nor does it appear as if the hair has been lost by rubbing. Captain Rippon also thinks that the bare patch is probably a normal characteristic of the species and he doubts whether the sores are due to rubbing. He states also that it certainly would seem to be too much of a coincidence to find only

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this area on the neck affected in that way in every case, ticks must be found on other parts of the body as well where the skin is protected by a full growth of hair which at the same time is capable of being rubbed by the animal at will. Captain Rippon in his letter to me also goes on to say that Dunbar Brander's theory would appear to suggest that the sore may be connected with rutting. This, he says, is interesting as the sore might be some secretory gland which functions only at times of sexual activity, but is there, he remarks, any evidence that the sores are seen only in the cold weather i.e. during the mating season? Major C. P. Evans in his book *Big Game Shooting in Upper Burma* has a lot to say on the subject of the sambar sore, *vide* pp. 144-8 of his book, but I will only quote a few extracts. He says that the Burman and Indian Shikaris state that the sambar is attacked by a parasite (I doubt whether they could explain what a parasite was) and that the sore is caused by the animal rubbing itself to get relief from the irritation. This he says no doubt is true so far as it goes; but they are quite unable to explain why sambar should invariably be attacked in exactly the same place, or why the sore should be as circular as if it were made by a pair of compasses, and why sambar alone of all deer should be so afflicted. But are sambar the only deer so afflicted? Haven't black buck in India got it? Evans goes on to say that he does not himself believe in the rubbing theory. If the beast rubbed itself against a tree or branch to get rid of the irritation it would do so with an up and down motion and the result would be irregular scratches along the throat. But strange to say in spite of the forbidding appearance of the sore sambar do not appear to be at all inconvenienced by it. Evans says that he has watched sambar, when out in the open both in India and Burma for half an hour or more at a time, on purpose to see whether the animals rubbed the sore; but he never saw any sambar whether young or old pay the slightest attention to it. That the disfigurement is caused by a peculiar parasite which only attacks the sambar is according to Evans quite certain; but why it should invariably confine its attentions to the throat, or why it should cause a complete circular sore and having done so, desist from further attack he is unable to explain. Judging by the bleeding spot in the centre of the circle it looks, according to Evans, as if the parasite having reached its limits, returned to the original spot and fed there, since it is, in full grown animals always quite raw, the remainder of the circle being merely bare and pink-looking. Seen in the early dawn this raw spot has quite a gruesome appearance.

Colonel C. H. Stockley also comments on the 'sambar sore' or 'sore neck' on page 153 of his book *Big Game Shooting in the Indian Empire*, but he adds nothing new except to say that he has shot sambar without the sore as well as with the sore. However let us hope we will have a complete or at least a partial solution of the mystery after Mr. Mitchell has examined the contents of the test tubes which will no doubt be forwarded to him by Mr. Mustill in due course.

The hunters in the Ruby Mines District of Upper Burma have

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stories about a small active little animal they call a *Sat Kalauk* which, although perhaps larger than a weasel, is said to be not unlike that animal in appearance. This creature is said to spring at and hang on to the throats of sambar as they move through the jungle. It appears they seize the sambar by the throat with their teeth and, after hanging on for a few seconds and drawing blood, drop off again. I wrote to Mr. Mustill, Game Warden, Burma about this matter and asked him whether he could make enquiries to get to the bottom of the matter. He promised to do so. *Sat Kalauk* in Burmese means the sambar's bell, *sat* meaning sambar, and *kalauk* a bell, or wooden neck knocker, or clapper. These bells are worn round the necks of elephants and buffaloes when they are loosed in the jungle so that their owners may know where the animals are as the clapping sounds of these bells can be heard quite a long way off. Why this ferocious little animal the *Sat Kalauk* should want to attack such large animals as sambar is a mystery. I see Mr. Peacock on page 274, of his book *A Game Book for Burma* etc. refers to the Indian Marten (*Charionia flavigula*) Burmese *Nabashing* as being the *Sat Kalauk*. He also says that many jungle Burmans insist that Martens occasionally run down and kill barking deer. There is no doubt about this. It is a very destructive animal and is often caught killing fowls, seizing the birds by the throat. As a matter of fact, there is a general belief in the Ruby Mines District, that the *Sat Kalauk* will kill and feed on the body of any animal it can pull down and all seizures by it are evidently made at the throat. Mr. Ryan of the Ruby Mines shot one of two pine martens that had killed a village goat and were eating it when he appeared on the scene and shot one of them. The death wound on the goat in this case was also on the throat. The pine marten is also very destructive to fruit and Indian corn gardens.

The most commonly seen game track in Burma is that of the sambar, yet, as Mr. Peacock truly remarks, one may hunt for days without seeing a single specimen. Stalking sambar on foot is by far the most sportsmanlike way of killing them, but I am afraid more are shot now-a-days from cars and in beats, or drives, or by hunters at night on foot equipped with electric torches, than by the legitimate means of stalking. The eyes of the animals are plainly seen at night when a torch is used and many a sambar has been done to death at night by this means and has had a charge of buck shot fired into its body at random only to get away to die, sometimes days afterwards, a miserable lingering death. Sambar are difficult animals to drive, marvels at finding a weak spot in a beat and most determined in breaking back. It is perfectly marvellous, as *Rohilla* says, with what complete silence so heavy a beast with his spreading head will make his way in front of the line through dense cover and over broken rocks. The sportsman may have sat for an hour with exemplary patience, silent, motionless and noiseless, at his post. A big sambar may have come up close without the 'gun' having had the faintest inkling of it, and may have been standing suspiciously sniffing the air, and listening with its huge ears, making up its mind for a

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further advance, should the beaters approach too near. Should the sportsman under such circumstances, seeing the beaters close up and imagining that all is over, move even an eyelid, the wary beast is off with a plunge and a crash, either back through the line of beaters, or down hill to turn their flank, sometimes giving the occupants of the less sought for posts below a chance of a shot. Another moment or two of motionless silence and the occupant of the post would have had an easy shot at the huge deer, as he walked delicately like Agag along the well known path, or quietly scrambled up the rocky defile to the top. All the other animals come along with much less concern or concealment; only the sambar stag is thus cautious.

It is certainly much grander sport following and stalking the sambar on foot. The ground may be difficult, steep, dangerous and rocky; but where a deer can climb a man can climb also. The jungle may be dense, and the foliage luxuriant, but the sportsman content to wander all day in the forest rifle in hand for the chance of obtaining a shot accompanied by only one or two men is sure to meet with ultimate success although he will probably not bring to bay so many animals as the man who lurks behind a tree or rock, and has the game driven up to him to be murdered at point blank range, or as the man, who dazzles the vision of an animal at night with the headlights of his car and then slaughters it in cold blood at five or ten yards range.

I have already referred to the large sambar stag shot by me the measurements of whose antlers I have given. I came upon this animal suddenly at about fifteen paces in more or less open country, when turning a bend of a stream in the Thayetmyo Yoma hills, where the rushing sound of the water drowned the foot-steps of myself and hunters. Two soft-nosed bullets from a double hammerless 303 Enfield Rifle accounted for him. The first bullet got him in the neck paralyzing him, whilst the second shot went through his heart and brought him down with a crash. Although a stag sambar does not appear to possess the vitality of some animals of lesser size that I have shot, I am of opinion that the 303 is not powerful enough for these large deer. A ·400, ·423, ·318 or even a ·375 would be more effective. Some people have of course shot them at close quarters in a drive using a 12 bore shot gun and lethal ball or even with L.G. or S.G. buck shot.

Sambar are, or were, until quite recently hunted on foot with dogs by sportsmen armed only with long hunting knives. The animal, which is not a great stayer at any time in any country, and seems also to succumb more easily to a rifle bullet than most animals, is easily run down and bayed by the dogs, when the sportsman steps in with his knife and administers the *coup de grâce*. It is a highly exhilarating but dangerous sport as I have experienced myself in Ceylon. A sambar stag can inflict a dangerous wound with his horns, whilst the hunter has also to be in the pink of condition to stay the pace. These animals can also rear up and strike out with their fore feet besides using their horns to gore one. Sambar when exhausted and run down by dogs or by human agency take, as often as not, to the nearest

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stream, and stand at bay in the deepest pool they can find until the end comes. It seems a pitiful end for such a grand beast. They take to water readily and swim with the body submerged, only the face and the antlers showing above the surface.

The skin of a sambar is useful if properly tanned and converted into leather for trunks, kit bags and foot wear. As a trophy the skin is useless because of the coarseness of the hair.

The horns, when in velvet, are much valued by the Chinese for medicinal purposes. Such horns when obtained are smoke-dried and sold for about Rs. 25 to Rs. 30 per pair. A Russian, at the present time, is doing a roaring trade in Korea by farming deer with the object of selling horns when in velvet to the Chinese.

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THE ORNITHOLOGY OF TRAVANCORE AND COCHIN.

BY

SĀLIM ALI.

With Notes by HUGH WHISTLER.

PART VII.

(*Continued from page 35 of this volume*).

SUB-FAMILY: BUBONINÆ.

Ketupa zeylonensis leschenaulti (Temm.). The Bengal Brown Fish-Owl.

Specimen collected: 932 ♂ 3-12-33 Nemmāra 300 ft.

Elsewhere noted at: Thattakād (200 ft.).

Colours of bare parts: Iris golden yellow; bill pale greenish grey, dusky on culmen and tip; legs and feet dusky yellow; claws horny brown.

[The specimen (♂) measures:

Bill.	Wing.	Tail.	Tarsus.
50	379	190	71 mm.

No other Travancore specimens seen.—H. W.]

Occasional solitary birds were observed on rocks in the Periyār River at dusk. A pair at Nemmāra had their domicile among large trees in the compound of the Travellers' Bungalow. In this locality the species was noted as fairly common. Its call—a subdued eerie ventriloquistic *boom-boom* etc.—was heard chiefly at dusk. On the whole, the Brown Fish-Owl is perhaps commoner in our area than the Survey records suggest. According to Ferguson (*J.B.N.H.S.*, xv, 667) it is 'common in forest land in the low country [of Travancore] near the sea coast'. He mentions specimens that had lived in captivity in the Public Gardens, Trivandrum, for 10 years. Elwes (*Ibis*, 1870, p. 527) found this owl common in the lower valleys of the Cardamom Hills.

In the Palni Hills, both Fairbank and Terry (*S.F.*, v, 392 and x, 469) have recorded it from Kodaikānal. In Ceylon it is represented by the typical race which has a general distribution up to 4,000 ft.

Breeding: The testes of the specimen (3 December) measured 10×5 mm. Ferguson gives the breeding season in Travancore as March and April.

Bubo bubo bengalensis (Franklin). The Indian Great Horned-Owl.

Specimens collected: 628 ♂ 19-4-33, 633 ♀ 21-4-33 Arāmboli 250 ft.

Elsewhere noted at: Nemmāra (300 ft.).

Colours of bare parts: Iris bright reddish-orange; bill horny brown; feet greyish-brown; claws horny brown.

[These specimens extend the known range of this species. The ♂ measures:

Bill.	Wing.	Tail.
42	365	185 mm.

—H. W.]

The Indian Great Horned-Owl has not been previously recorded from Travancore or Cochin. It was, in fact, not known to occur in South India south of about Madras on the east and the Nilgiris on the west.

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At Nemmāra (Cochin) only a single example was observed in open teak forest at the base of the Nelliampathy Hills, on the edge of the Pālghāt Gap. At Arāmboli (South Travancore), however, the birds were not uncommon. During the daytime they kept to fissures and hollows among the gigantic boulders on the hillocks flanking the Arāmboli Gap, whence they issued forth at dusk with deep resonant hollow calls of *Bu-bo* etc. At this hour they were usually seen perching on the summits of boulders etc. whence they presently glided off on outstretched wings for enormous distances—occasionally covering half a mile or more without a flap—to their accustomed feeding grounds in the cocoanut plantations and cultivated country about the town.

It has not been met with in the Palni Hills and it evidently does not occur in Ceylon.

Breeding: The gonads of the specimens (19 and 21 April) were inactive. No other data in this regard was procured by the Surveys.

Huhua nipalensis nipalensis (Hodgson). The Forest Eagle-Owl.

Not met with by the Surveys.

Ferguson (*J.B.N.H.S.*, xv, 667) states that this owl is not common in Travancore. Two specimens taken alive in the low country forest lived for some time in the Public Gardens at Trivandrum. Another was shot in the High Range.

It has not been recorded in the Palnis, but it occurs in the Ceylon hills.

Breeding: According to J. Stewart (*Fauna*, iv, 418) the breeding season in Travancore is December and January.

In dense mixed forest at Thattakād (200 ft.—February 1933) and also at Tenmalai (500 ft.—March 1933) after dark and frequently all through the night, was heard the long-drawn kite-like whistling call of an owl, the identity of which I was unable to establish. A specimen of this bird was shot while calling in December 1932 in the Biligirirangan Hills (Coimbatore District), but unfortunately lost in the scrub in the darkness. In the beam of the electric torch it looked about the size of a kite. Can it have been this Eagle Owl?

Otus bakkamoena bakkamoena Pennant. The Ceylon Collared Scops Owl.

Specimens collected: 459 ♀ juv. 16-3-33 Rājampāra 1,350 ft.; 933 ♀ 3-12-33 Nemmāra 300 ft.

Elsewhere noted at: Kōttayam; Chālakūdi.

Colours of bare parts: *Juvenile* (459): Iris yellow; bill pale horny brown; feet greenish-plumbeous; claws horny brown. *Adult* (933): Iris brown; bill horny brown, paler on lower mandible; mouth pink; legs and feet brownish flesh colour with a pale creamy tinge; claws pale horny brown.

[Additional specimens examined:

Brit. Mus. Coll.: ♀ 3-3-96 Zoo Gardens, Trivandrum (Nair); o? no date Trivandrum (Fry); ooo? no date Mynall (Bourdillon). Cf. *S.F.*, vii, 34.

Measurements:

	Bill.	Wing.	Tail.	Tarsus.
2 ♀♀	21-22	144-147.5	68.5-69.5	27.5-30.5 mm.

The juvenile No. 459 of this species is remarkably different from the adult, but I have no doubt that it is correctly identified as a juvenile in my collection from Sikkim of the closely allied *O. b. lettia* exhibits very similar differences. The upper plumage is grey on the forehead, crown, sides of the head and nape, and browner on the mantle, back, rump, upper tail coverts and lesser wing coverts, the feathers finely stippled and vermiculated with dark sooty brown; wings and tail, including tertiaries and greater and primary coverts as in the adult (grey phase); chin whitish; remainder of lower plumage greyish-fulvous, the ruff somewhat brighter, all feathers faintly barred and stippled with sooty brown.—H. W.]

This little owl was fairly common in the localities named where it kept to well-wooded compounds in villages and towns, and also to deciduous forest. Its mellow but monotonous *wut?-wut?* note, repeated at intervals of 3 seconds

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or so, was usually heard at dusk and late into the night, and then again in the early mornings. It probably continues throughout the night.

Ferguson (*J.B.N.H.S.*, xv, 667) describes the Scops Owl as very common throughout the low country in Travancore, but says that it does not ascend the hills. Bourdillon (apud *Nidification*, iii, 516) says that it also occurs in the foothills of Travancore and up to 2,000 ft. elevation.

There is no record of this species in the Palni Hills. It is common and generally distributed in Ceylon, up to 3,000 ft.

Breeding: Specimen No. 459 (18 March) was a juvenile with a very soft skull. It appeared to be about a month old and was moulting out of down plumage.

Bourdillon (*Fauna*, iv, 424) found this owl laying its eggs in holes in buildings in Travancore, but elsewhere it is said to nest in natural holes in trees. The breeding season in Travancore is given as January and February (*Nidification*, iii, 516).

[Otus sunia rufipennis (Sharpe). The Indian Scops Owl.

Not met with by the Surveys. Mr. Whistler mentions (*J.B.N.H.S.*, xxxviii, 236) that in the British Museum there is a ♀ collected by R. H. Morgan in the Pālghāt Hills in April 1876, and three Anjango specimens without precise data. The species probably occurs in our area since the Pālghāt Hills are sufficiently close to the northern boundary of Cochin State to allow of the probability even if the Travancore evidence is ignored, knowing that the 'Anjango' specimens are often of uncertain and doubtful origin.]

Athene brama brama (Temminck). The Southern Spotted Owlet.

Specimens collected: 538 ♂ juv., 539 ♀ juv., 540 ♀ juv., 541 ♀ ad. 8-4-33, 565 ♀ juv., 566 ♂ juv. 11-4-33 Cape Comorin ca. S.L., 702 ♀ 21-7-33 (Beach), 856 o? (Golf Links, ca. 100 ft.) Trivandrum.

Elsewhere noted at: Arāmboli (250 ft.); Wadakkāncheri (400 ft.); Trichūr; Ernākulam.

Colours of bare parts: *Juvenile*: Iris lemon yellow or greyish yellow; bill pale sea green; feet greenish grey; claws horny black. *Adult*: 'Iris yellow; bill plumbeous; mouth bluish pink; feet plumbeous; claws brownish black' (Pillai).

[No additional specimens with proper data seen.

Measurements:

	Bill.	Wing.	Tail.
1 ♂	21	158	71.5 mm.
2 ♀♀	21	156	68-71.5 mm.

The post-nuptial moult is complete and there is no spring moult. The post-juvenal moult does not appear to include the wings and tail.

Dr. C. B. Ticehurst reports on the down plumage of this owlet as follows: 'Pure white, short and very soft prepennae cover body, except apterions of lateral neck, lateral body in front and each side of spinal tract above. Some preplumulae of same type of down on lateral apteria in front.'—H. W.]

This species is without doubt the commonest owl in Travancore. In our experience and that of Ferguson (*J.B.N.H.S.*, xv, 668) it is confined to the low country, but *Nidification* (iii, 525) says that it is also found in the Travancore hills up to 1,000 or 1,500 ft. elevation.

The birds may be met with usually in the neighbourhood of villages and cultivation, and wherever there are topes of large trees—especially old mango, tamarind and the like—with hollow trunks and branches to furnish harbourage. Old buildings and crumbling walls also provide suitable dwelling and nesting sites. As in Ferguson's day, they freely continue to inhabit the old ruins of the fortified 'Travancore Lines' near Cape Comorin.

Sunlight does not seem to inconvenience this owlet greatly and it may frequently be seen on the move during the day when, however, it is mercilessly chivvied by other birds.

It has not been recorded from the Palni Hills and it does not occur in Ceylon.

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Breeding: Four of the April specimens were juvenile in various stages of the down plumage. There is a marked discrepancy in the sizes of the young in a brood which suggests that incubation commences from the laying of the first egg. As the full clutch consists of 3 or 4 eggs there may often be a difference of as many days between the ages of the first and the last to hatch.

At Cape Comorin and Arāmboli, between 8 and 16 April, numerous nests were found in holes in crumbling walls and buildings or rotten tree trunks and branches. All these nests contained either hard set eggs or downy chicks. The nests emitted a strong and nasty stench. A number of family parties were also observed about at this period.

Ferguson gives the breeding season in Travancore as March and April.

Glaucidium radiatum malabaricum (Blyth). The Malabar Jungle Owlet.

Specimens collected: 33 ♂ 7-1-33 Marāiyūr at 4,500 ft.; 461 ♀ 18-3-33, 471 ♂ 19-3-33 Rājampāra 1,350 ft.; 781 ♀ 3-8-33 (Kōvalam ca. 70 ft.), 830 ♀ 11-8-33 (Pūlayanārkotta, near Veli Lake) Trivandrum Environs.

Elsewhere noted at: Kūriārkūtti (1,600 ft.—Annemalai Hills, Cochin).

Colours of bare parts: Iris bright lemon yellow; bill and feet dirty greenish-yellow; claws horny brown.

[Additional specimens seen:

Brit. Mus. Coll.: ♀ 12-3-78 Travancore (Bourdillon); ♂♂♀ no date Mynall (Bourdillon).

Measurements:

	Bill.	Wing.	Tail.	Tarsus.
4 ♂♂	19.5-21.5	128-135	65-69	22 mm.
5 ♀♀	19.5-21	124.5-134	61.5-68	20-22 mm.—H. W.]

The Jungle Owlet is not uncommon in the deciduous forest tracts of Travancore and Cochin, chiefly in the low country and foothills but occasionally up to about 2,500 ft. One of the specimens was shot at 4,500 ft. elevation.

It was usually met with, singly or in pairs, in secondary open deciduous jungle, especially the bamboo facies. The bird gives itself away by fussily flying off from its perch on the approach of the observer, and seems little inconvenienced by bright sunlight. It settles on another branch or tree a short distance away, sitting upright and motionless but with head screwed round and staring hard at the intruder, looking all the time exactly like the stump of a dead branch.

There is no record of this owlet from the Palni Hills though it probably occurs in the deciduous country about their eastern base. *Glaucidium castanotum* found in a wet zone in Ceylon may possibly prove to be a race of this species. (See Eastern Ghats Survey, *J.B.N.H.S.*, xxxviii, 237.)

Breeding: Specimens Nos. 461 and 471 (18 and 19 March) were evidently preparing to breed shortly. Some of the ovarian follicles of the former were 1-1.5 mm. in diameter, while the testes of the male measured 6×4 mm. No other breeding data was procured by the Surveys.

According to Ferguson (*J.B.N.H.S.*, xv, 669) the Jungle Owlet breeds in Travancore in March.

Ninox scutulata hirsuta Temm. & Lang. The Southern Indian Hawk-Owl.

Not met with by the Surveys but I have seen a specimen in the Trivandrum Museum labelled ♀ 19-6-1893 Trivandrum, and another in the museum of the Maharaja's College, Ernākulam, obtained in that neighbourhood.

[Specimens seen:

Brit. Mus. Coll.: ♂ 26-11-79, ♂ 24-2-78, ♂ 3-12-74 Mynall (Bourdillon).

3 ♂♂ measure:

Bill.	Wing.	Tail.
22-23.5	197-198	114-116 mm.—H. W.]

Ferguson writes (*J.B.N.H.S.*, xv, 668) that the Hawk-Owl is not uncommon in the Travancore hills at about 2,000-2,500 ft. elevation, and that it also occurs in forest land in the low country.

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The Surveys appear to have overlooked this species completely. Bourdillon (*S.F.*, iv, 373) says that it frequents heavy jungle and the borders of clearings where on moonlight nights during winter numbers may be heard calling to one another. He describes the call as a monotonous double hoot (the first syllable prolonged, the second cut short) uttered from the bough of some bare tree.

In Ceylon this Hawk-Owl is generally distributed up to 4,000 ft.

Breeding: January to May are said to be the breeding months in Travancore (Bourdillon, *Nidification*, iii, 536).

ORDER: ACCIPITRES.

FAMILY: PANDIONIDAE.

Pandion haliaëtus haliaëtus (Linn.). The Osprey.

Specimen not obtained.

Noted at: Cape Comorin.

Ferguson states (*J.B.N.H.S.*, xv, 668) that in Travancore the Osprey is a winter visitor to the lakes near the coast. Its status in Cochin is possibly the same although it cannot be anything like common since the Survey failed to come across it there altogether. In Travancore also it was not noted about the Vembanād Lake or in such other likely localities by the backwaters in February. Only a solitary bird was observed by Humayun Abdulali near an irrigation tank, a couple of miles inland from Cape Comorin, on 9 April by which time the hot weather emigration had presumably commenced.

FAMILY: ÆGYPIIDÆ.

Sarcogyps calvus (Scopoli). The Black, Pondicherry, or King Vulture.

Specimen not collected:

Noted at: Marāiyur (3500 ft.); Thattakād (200 ft.); Peermade (3,200 ft.); Kūmili (3,000 ft.); Chālakūdi; Pādagiri (3,000 ft.).

This species is perhaps the commonest vulture in Travancore and Cochin, and is generally distributed throughout the area. At Marāiyūr it was noted as practically the only vulture. While their numerical proportion to other vultures at wayside carcases of cattle remains more or less constant in the low country—namely the usual two or three birds to each gathering—on one occasion at Peermade (3,200 ft.) over 20 of these birds had collected at a carcase to the almost complete exclusion of the other species. At Pādagiri also an assemblage of about 30 Black Vultures were observed in company with others of their ilk at the viscera and some scrappy remains of a Nilgiri Tahr after the rest had been cut up and removed by the coolies. I have not seen such large concentrations of this vulture elsewhere.

In the Palni Hills, Fairbank (*S.F.*, v, 391) observed it rarely at the base of the hills, and Terry (*S.F.*, x, 468) more frequently at Pulungi. It is not found in Ceylon.

Breeding: There is no published record of its breeding in Travancore or Cochin.

Howard Campbell has found it breeding at Kodaikanal in the Palni Hills (*Nidification*, iv, 7).

[**Gyps fulvus fulvescens** Hume. The Indian Griffon Vulture.

Specimen not collected.

I include this vulture in my Travancore list with diffidence and with a full realisation of the fact that no authentic records apparently exist from further south in the peninsula than Dūmagūdiem on the Godāveri River. I must admit also that I often find it extremely difficult to differentiate between this vulture and *indicus* in the field and that under the circumstances the bare sight records can carry no real scientific value. However, as the note was made in the field with a proper realisation of these difficulties and under the two species separately, it might be as well to transcribe it for what it is worth, in the hope that a future collection of vultures may prove or disprove its correctness. The record I have is as follows: 'Kūmili 3,000 ft.—28 February.

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Often suspected, but at least one definitely of this species seen in an assemblage at a carcase near the Travellers' Bungalow'.

Vultures have been consistently neglected by collectors due, as in the present case, to lack of storing accommodation which of necessity has to be restricted owing to the itinerant nature of survey work. These and the larger birds of prey generally constitute, on this account, the weakest section of most collections. Yet they are a most important group and our knowledge concerning them is in many cases surprisingly deficient. Their collection may be recommended to people who are more or less permanently stationed in various localities and who are not obsessed by immediate difficulties as regards the storage and transport of their material.]

Gyps indicus indicus (Scopoli). The Indian Long-billed Vulture.

Specimen not collected.

Noted as follows: 'Marāiyūr 3,500 ft.—13 January. 7 or 8 birds appeared suddenly at a carcase of a dog when not a single one was in evidence in this locality during the last 10 days.'

'Kūmili 3,000 ft.—28 February. Several at a carcase near Travellers' Bungalow.'

'Pādagiri 3,000 ft.—19 December. Over 15 birds of this species at remains of Nilgiri Tahr in steep valley, in association with *S. calvus* and Kites.'

The Long-billed Vulture is not common as vultures go, but generally distributed in small numbers in Travancore, and its status in Cochin is about the same. Ferguson (*J.B.N.H.S.*, xv, 668) considered it rare in the former area. He mentions a live specimen brought in from Nāgercoil, and that was the only locality he knew where it had been obtained in Travancore.

Fairbank and Terry both include it in their Palnis lists where, however, it does not seem to be common. It does not occur in Ceylon.

Breeding: There are no published records of its breeding in our area.

Pseudogyps bengalensis (Gmelin). The White-backed or Bengal Vulture.

Specimen not collected.

Noted at: Peermade (3,200 ft.); Kūmili (3,000 ft.); Arāmboli (250 ft.); Wadakkāncheri (400 ft.); Nemmāra (300 ft.); Pādagiri (3,000 ft.).

This species is perhaps the commonest vulture in Travancore and Cochin though by no means as abundant as it is, for instance, in the Deccan and in many other parts of the peninsula. Carcases, whether in the low country or on the hills, seldom elude these birds for long. In an assemblage of about 40 vultures at the remains of a Nilgiri Tahr shot in the Nelliampathies (ca. 3,500 ft.) only 2 or 3 individuals of this species were observed, however. On these hills, according to Kinloch (*J.B.N.H.S.*, xxvii, 943) the White-backed Vulture comes up as a temporary visitor from the plains and only roosts up there if gorged. This is probably true of the Travancore hills also.

Fairbank and Terry appear to have overlooked it in the Palni Hills.

Breeding: According to T. F. Bourdillon (*J.B.N.H.S.*, xv, 669) a colony of these vultures used to build regularly every year in a bit of forest adjoining Oliver's estate [?] in the Ashāmbū Hills in South Travancore. When the forest was cleared for coffee, the birds entirely deserted the place. He gives the breeding season in Travancore as February to April.

Neophron percnopterus ginginianus (Latham). The Smaller White Scavenger Vulture.

Specimen not collected.

Noted at: Nāgercoil; Cape Comorin; Arāmboli (250 ft.); Wadakkāncheri (400 ft.); Nemmāra (300 ft.).

The Scavenger Vulture is not uncommon in the dry low country of South Travancore—and in similar facies also in Cochin—though nowhere abundant. It frequents the neighbourhood of towns and villages the population of which provide it directly or indirectly with sustenance.

Kinloch (*J.B.N.H.S.*, xxvii, 279) only observed a solitary bird by some coolie lines in the Nelliampathy Hills.

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In the Palni Hills, on the other hand, Fairbank (*S.F.*, v, 392) and Terry (*S.F.*, x, 468) found this vulture on the slopes and occasionally on the tops of the hills up to 5,000 ft. Whether it is a resident on these hills or merely visits them temporarily from the plains in search of food—as is likely—is not stated.

It is a straggler into Ceylon.

Breeding: At Arāmboli (18 April) a nest was located on a ledge of an inaccessible rock-scarp which evidently contained young. One of the owners visited the nest with a beakful of food that through field glasses looked like ordure. No published records of its breeding in Travancore or Cochin are available.

Family: Falconidæ.

Subfamily: Falconinæ.

Falco peregrinus calidus Latham. The Eastern Peregrine Falcon.

Specimen not obtained.

Noted (either this or the next species?) at: Kōttayam backwaters near Alleppey (18 February); Cape Comorin (10 April).

The Peregrine is evidently an uncommon winter visitor to Travancore and Cochin. The Survey definitely recognised it only once when a bird swooped down on a wounded Caspian Tern and attempted to carry it off.

Ferguson states (*J.B.N.H.S.*, xv, 672) that his collectors secured a single specimen on the backwaters in North Travancore in December 1903 and saw a second, also near the backwaters, at Quilon.

Falco peregrinus peregrinator Sundevall. The Shahin Falcon.

Not met with (?) by the Surveys.

Ferguson records (*J.B.N.H.S.*, xv, 673) a single specimen shot by a Mr. Walch in Trivandrum and sent to the Museum in November 1893.

Kinloch (*J.B.N.H.S.*, xxvii, 943) says the Peregrine is common on the Nelliampathy Hills and breeds on the precipices of the northern slopes. Mr. Whistler points out (*J.B.N.H.S.*, xxxviii, 418) that this is probably the race to which Kinloch refers.

[**Falco jugger** Gray. The Laggar Falcon.

I have a doubtful sight record for this species from the Ūrūmbikera Reserve Forest, near Mūndakāyam, ca. 1,000 ft. elevation—16 February. A solitary bird was being chivvied by *Astur badius*.

There are no published records of its occurrence in Travancore or Cochin, and apparently only 2 for the whole of the Madras Presidency (Whistler, *J.B.N.H.S.*, xxxviii, 419).]

Falco severus rufipedoides Hodgson. The Indian Hobby.

Specimen not obtained.

Noted at: Cape Comorin (ca. S.L.); Pādagiri (3,000 ft.)?

Mr. Whistler has seen the following specimens in the British Museum: ♂ no date Travancore (Bourdillon); ♂ 27-4-1874 Kowdiar, S. Travancore; ♂ 14-2-14 Aneichardi (Stewart).

The status of the Hobby in Travancore and Cochin is in some doubt. The Bourdillon brothers considered that it might breed in Travancore, but Ferguson says (*J.B.N.H.S.*, xv, 673) that it may be seen on the hills and occasionally in the low country in the cold season. He evidently believed it to be only a winter visitor to Travancore.

Kinloch (*J.B.N.H.S.*, xxvii, 943) found it not uncommon in the Nelliampathy Hills. As he does not specify any season, it is evident that he also believed it to be a resident.

Nidification (iv, 34) says: 'It certainly occurs and must breed in the Travancore hills.'

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Falco tinnunculus tinnunculus Linn. The European Kestrel.

Specimen collected: 918 [♂ ad.] 29-11-36 Wadakkāncheri 400 ft.
Additional specimen seen by Mr. Whistler:
Brit. Mus. Coll.: ♂ imm. Travancore (Fry).

Falco tinnunculus objurgatus (Stuart Baker). The Indian Kestrel.

Specimens collected: 551 ♀ 9-4-33, 573 ♀ 12-4-33 Cape Comorin S.L.
Elsewhere noted (races undifferentiated): Marāiyūr (3,500 ft.); Sānthanpāra (3,500 ft.); Peermade (3,200 ft.); Camp Derāmalai (3,000 ft.); Kūriārkūtti (1,600 ft.); Nemmāra (300 ft.); Pādagiri (3,000 ft.); Karūpadanna (ca. S.L.).

[Additional specimens of *objurgatus* examined:
Brit. Mus. Coll.: ♂ ad. 2-12-78 Travancore (Bourdillon); [♂ ad.] ♀ 20-2-14 Aneichardi (Stewart); [♂ ad.] ?-3-75 Eridge (Bourdillon).

Measurements:

	Wing.	Tail.
3 ad. ♂♂	228-235	148-163 mm.
3 ♀♀	237-257	145.5-169 mm.—H. W.]

Colours of bare parts: Iris brown; eyelids, cere and basal portion of lower mandible greenish-yellow; bill plumbeous with horny brown tips; mouth greyish pink; tongue flesh coloured with dark tip; legs and feet bright chrome yellow; claws black.

The Indian Kestrel as a resident is fairly common but not abundant in Travancore and Cochin, in the low country as well as on the hills. During the breeding season it is probably commoner in the latter where it is said to nest on the crags and precipices. Its numbers are augmented in winter by the influx of the migratory European race, but the two are by no means easy to differentiate in the field.

The birds were usually met with singly, perched upon dead trees, telegraph poles or stones on grass-covered hillsides, in open cultivated country and by the backwaters. They also resorted to the stubble and scraggy grass-covered patches by the seashore. They frequently occupy the same look-out post day after day, and appear to have well-defined feeding territories. The birds either quarter the ground, hover and pounce upon their prey—field-mice, lizards, locusts etc.—or procure it in the manner of a shrike, swooping down on the ground from their perch and returning with it.

Both Fairbank (*S.F.*, v, 392) and Terry (*S.F.*, x, 469) found the Kestrel fairly common in the Palni Hills. The former observed it at 7,000 ft. elevation on Mount Nebo till the middle of June and considered it a permanent resident on the top of the Palnis.

The European race is found as a winter visitor in Ceylon, but there is no proof that the Indian Kestrel occurs there at all.

Breeding: Specimens Nos. 551 (9 April) and 573 (12 April) both had conspicuously granular ovaries—with the follicles measuring 1 mm. or more in diameter. They were apparently in pre-nuptial body moult and preparing to breed shortly.

T. F. Bourdillon (*J.B.N.H.S.*, xv, 673) observed a pair feeding their young in a nest on an inaccessible ledge of rock at ca. 2,800 ft. elevation during April.

Nidification (iv, 44) states that Bourdillon and Stewart knew it to breed in North and South Travancore and that it has also been obtained in June and July in the Nelliampathy Hills.

[**Aquila nipalensis** Hodgson. The Steppe Eagle.

North Travancore has been included in the distribution of this eagle (*Fauna*, v, 71) on the authority of J. Stewart. As Mr. Whistler has pointed out in the *Journal* (xxxviii, 423), however, eagles are notoriously difficult to identify, and, as Stewart apparently did not preserve the specimen for comparison with authentic examples, further proof is desirable before we can accept its occurrence within this area.]

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[**Aquila pomarina hastata** (Lesson). The Small Indian Spotted Eagle.

The *Fauna* (v, 75) and *Nidification* (iv, 52) both say that this eagle is uncommon in Travancore. On what authority its occurrence is based is not known since no specimens apparently exist.]

Hieraëtus fasciatus fasciatus (Vieillot). Bonelli's Eagle.

Not met with by the Surveys, neither included in Ferguson's Travancore list. Apparently, however, Stewart took many nests in Travancore (*Nidification*, iv, 54).

Hieraaëtus pennatus (Gmelin). The Booted Eagle.

Not met with by the Surveys.

Ferguson (*J.B.N.H.S.*, xv, 669) describes the Booted Eagle as an occasional winter visitor to Travancore. The Trivandrum Museum in his time possessed a single specimen shot in that locality in February. I have seen another specimen in the same museum labelled: o? 5-11-93 Thottam.

Lophotriorchis kienerii (Sparre). The Rufous-bellied Hawk-Eagle.

Specimen not obtained.

Noted at Marāiyūr (above Kūmarikkaimalai, 7,000 ft.—10 January); Thattakād (200 ft.—8 February).

On both occasions single birds were observed soaring above afforested hillsides. The ferruginous underparts were conspicuous and diagnostic.

Ferguson says (*J.B.N.H.S.*, xv, 669) that the Rufous-bellied Hawk-Eagle is rare in Travancore. He shot an example at the foot of the hills in South Travancore in April 1901, and mentions that F. W. Bourdillon had a specimen given to him which was shot at an elevation of 2,200 ft. in the act of swooping at a chicken. According to the *Fauna* (v, 81) in Travancore it is commonest between 1,500 and 3,000 ft. elevation.

It is said to occur in Ceylon.

Breeding: A. M. Kinloch (*J.B.N.H.S.*, xvii, 1027) obtained a nest with a young bird in the Annemalai Hills in December 1906. Since then, Stewart (apud *Nidification*, iv, 57) has taken many nests and eggs in Travancore, and he gives a good account of its breeding habits. It evidently breeds in heavy forest between 1 and 4,000 ft. elevation, but principally between 1,500 and 3,000 ft. He took eggs—invariably c/1—from 27 November to the end of March.

Ictinaëtus malayensis perniger (Hodgson). The Indian Black Eagle.

Specimen not obtained.

Noted at: Marāiyūr (3,500-7,000 ft.); Sānthanpāra (3,500-5,000 ft.); Mūthūkūzhi, Ashāmbū Hills (at 4,000 ft.); Kūriārkūtti (1,600-4,500 ft.); Nemmāra (300-1,000 ft.).

This eagle is a fairly common and resident species in the well-wooded portions of both the States, from the foothills country up to the highest elevations. In the Nelliampathy Hills, Kinloch (*J.B.N.H.S.*, xxvii, 942) describes it as very common.

The birds were usually seen singly—sometimes in pairs—sailing majestically above the wooded ravines and hill-forest. In the Cardamom Hills, a trio (parents training full-fledged young?) were observed on one occasion indulging in a remarkable display of gliding, soaring and nose-diving above a grassy hilltop at ca. 4,000 ft. From my level, or a little below, they rose with no perceptible effort on motionless wings to about 200 ft. above in less than 15 seconds. Within a couple of minutes the birds were quite 5 to 600 ft. above me, without once flapping their wings. They were quite obviously disporting themselves for sheer pleasure.

Fairbank (*S.F.*, v, 392) observed 3 of these eagles at different places in the Lower Palnis at about 4,000 ft., circling slowly just above the tree-tops in the valleys.

It is found in Ceylon.

Breeding: According to *Nidification* (iv, 59) Stewart took eggs in Travancore at elevations between 1,000 and 4,000 ft., normally from November to February but also once on 9 September. The nests are said to be built in tall trees in evergreen forest, often so overgrown with creepers as to conceal

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the nest completely. Sometimes they are built in more conspicuous positions in opener trees. A single egg is usually laid, but very rarely 2 may be found.

Bourdillon gives a very different account of its breeding in Travancore. He says it builds on cliffs (!) at elevations of 2,000 ft. and upwards in January and February, laying from 1 to 3 eggs (*J.B.N.H.S.*, xv, 670).

Nisaëtus cirrhatus cirrhatus (Gmelin). The Indian Crested Hawk-Eagle.

Specimens collected: 12 ♂ 5-1-33 Marāiyūr 3,500 ft.; 248 ♂ 6-2-33 Thattakād 200 ft.

Elsewhere not noted.

Colours of bare parts: Iris bright lemon yellow; cere and rhampotheca slaty black, greenish-grey at gape and plumbeous at chin; mouth pink; feet dull yellow; claws black.

[The specimens measure:

	Bill.	Wing.	Tail.	Tarsus.
2 ♂♂	43-44	351-416	244-280	90-105 mm.

N.B.—The wing and tail of the bird with small measurements are very worn and are therefore somewhat below normal.—H. W.]

The Crested Hawk-Eagle is perhaps commoner in Travancore and Cochin than the Survey records suggest. Both the specimens were shot on the edge of mixed deciduous and evergreen forest.

According to Ferguson (*J.B.N.H.S.*, xv, 670) this species is common in the low country of Travancore and less so on the hills. In the Nelliampathy Hills, Kinloch (*J.B.N.H.S.*, xxvii, 943) found it very common. The former says it is very destructive to poultry, the latter that it feeds on Jungle Fowl.

Breeding: Specimen No. 12 (5 January) was presumably breeding. Its testes measured 19×9 mm.

Ferguson gives the breeding month in Travancore as March.

Nisaëtus cirrhatus ceylonensis (Gmelin). The Ceylon Crested Hawk-Eagle.

The *Fauna* (v, 87) and *Nidification* (iv, 64) both extend the distribution of this race to include South Travancore where Stewart claims to have found it very numerous and to have taken many eggs between early December and the end of March.

I do not know if Stewart ever actually collected specimens of the birds, and if so where these are at present, and whether he correctly attributed them to this form. The only Travancore specimen to which Mr. Whistler has had access is an 'Anjango' bird in the British Museum which is the type of Hume's *Spizaëtus sphynx* (*S.F.*, i, 319).

Nisaëtus nipalensis kelaarti Legge. The Ceylon Feather-toed Hawk-Eagle.

Specimens collected: 868 ♂ 15-11-36 Parambikolam, ca. 1,600 ft.—Annamalai Hills, Cochin.

Elsewhere not recognised or noted.

Colours of bare parts: Iris bright lemon yellow; bill including cere horny slate; mouth pink; feet dull yellow; claws black.

[The specimen ♂ measures:

Bill.	Wing.	Tail.	Tarsus.
46	402	261	98.5 mm.

Additional specimens examined:

Brit. Mus. Coll.: o 18-12-76, o 9-7-78, o juv. no date Mynall (Bourdillon). —H. W.]

This Hawk-Eagle is undoubtedly rare in Travancore where Ferguson says (*J.B.N.H.S.*, xv, 670) it is found as such only on the hills.

The specimen was killled with a stick by a fireman of the Cochin Forest Tramway in the act of swooping down on his chickens! Parambikolam is a cluster of a few huts at the terminus of the tramway amidst fairly heavy mixed deciduous and evergreen forest.

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Breeding: The testes of the specimen were inactive. Stewart (apud *Nidification*, iv, 68) has taken nests and eggs in the Travancore hills, mostly between 1,000 and 3,000 ft., in dense evergreen forest. Occasionally also in deciduous forest with trees of immense size and considerable undergrowth. The nests are placed at heights of 80-100 ft. The season is said to be from December to the end of March most eggs being laid in January. C/1 is said to be the invariable rule.

Circaëtus ferox (Gmelin). The Short-toed Eagle.

Not met with by the Surveys.

Apparently no specimens exist from actually within the boundaries of Travancore or Cochin. A bird that died in the Trivandrum Zoo recently was sent for examination to Mr. Whistler by Mr. N. G. Pillai, the Museum curator. Regarding this specimen, the latter writes: 'From the Zoo records I can only make out that a couple of these birds were caught alive from Thiruppuramkunram, a village in the Tinnevelly District. The Zoo curator assures me that he has seen this species round about Arāmboli.'

As the Tinnevelly District of Madras adjoins Arāmboli in Travancore and the terrain in both these areas is very similar—light deciduous scrub jungle and cultivation—there is no reason to doubt the possibility of the Short-toed Eagle occurring here.

The species has not been recorded from Ceylon.

Breeding: According to *Nidification* (iv, 69) 'Stewart took two or three nests in the open on the outskirts of forest' in Travancore. The season is not specified, but it is given for most of its range as December to March.

Hæmatornis cheela melanotis (Jerdon). The Crested Serpent-Eagle.

Specimen collected: 63 ♂ 11-1-33 Marāiyūr 3,500 ft.

Elsewhere noted at: Mūnnār (5,000 ft.—Kanan Devan Hills); Sānthanpāra (3,500 ft.—Cardamom Hills); Thattakād (200 ft.); Peermade (3,200 ft.); Tenmalai (500 ft.); Balamore Estate (2,000-4,000 ft.—Ashāmbū Hills); Kūriārkūtti (1,600-2,500 ft.—Annemalai Hills); Wadakkāncheri (400 ft.); Nemmāra (300 ft.); Pādagiri (3,000 ft.—Nelliampathy Hills).

Colours of bare parts: Iris, bright golden yellow; cere, skin above eye and eyelids lemon yellow; bill plumbeous, brownish on culmen and at tip; legs and feet dirty yellow; claws black.

[Additional specimens seen:

Brit. Mus. Coll.: ♂ 22-1-67 Nundur; ♂ no date Travancore (Fry); ♂ 9-10-74, ♂ ?-3-76 Mynall (Bourdillon).

Trivandrum Mus. Coll.: ♂ 24-10-03 [Travancore].

Measurements:

	Bill.	Wing.	Tail.	Tarsus.
6 ♂♂	42.5-46	357-434	211-279	91-106.5 mm.

For the supposed occurrence and breeding of both this and the Ceylon race at different altitudes in Travancore (*Nidification*, iv, 72-75) see Eastern Ghats Survey Report, *J.B.N.H.S.*, xxxviii, 426-27.—H. W.]

The Crested Serpent-Eagle is a fairly common resident species in the well-wooded tracts of Travancore and Cochin, evergreen as well as deciduous. It is found in the low country and up to at least 5,000 ft. in the hills, and no doubt higher still. The birds were usually observed in pairs, soaring and circling on motionless wings—often at great heights—above forest-clad hills and sholas, or perched in some lofty tree within or on the edge of forest. Its call of three loud, high-pitched screaming notes—*Kee-ki-ki* were commonly heard when the birds were soaring and helped to reveal thir identity at tremendous heights.

In the Palni Hills, Fairbank (*S.F.*, v, 392) only saw a single pair which would suggest that it is rather uncommon there.

In Ceylon it is replaced by the smaller race *H. c. spilogaster* Blyth.

Breeding: The testes of the specimen (11 January) were inactive. The bird was exceedingly fat. No first hand data as regards breeding was pro-

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cured by the Surveys. Stewart (apud *Nidification*, iv, 72) found nests of this Serpent Eagle in trees beside the Pūnalūr, Kallar and Shencottah streams in Travancore, and gives the season as December to March. Only a single egg is said to be laid.

The same collector is also credited in *Nidification* with having found the Ceylon race breeding in some numbers chiefly between 500 and 2,000 ft. in the hills of South Travancore from January to March. As pointed out by Mr. Whistler, there seems to be some confusion here and further authentic data and material seem desirable in order to prove that both the forms do in fact occur and breed in Travancore. It is apparently not easy to trace the specimens collected by Stewart and on which his statements are based.

Butastur teesa (Franklin). The White-eyed Buzzard-Eagle.

Not met with by the Surveys.

Apparently overlooked as according to Ferguson (*J.B.N.H.S.*, xv, 670) it is not uncommon in the low country of South Travancore, but does not ascend the hills. However, under the circumstances I cannot but imagine that it must be somewhat rare since a large and familiar bird as this is not easy to miss.

Haliaëëtus leucogaster (Gmelin). The White-bellied Sea-Eagle.

Not met with by the Surveys, neither recorded in Travancore or Cochin by previous observers.

It is not known on what authority the definite statement in *Nidification* (iv, 78) that it breeds in Travancore is based. That it *may* occur and breed along the coast, however, is not improbable.]

Ichthyophaga ichthyaëtus (Horsfield) subsp.? The Grey-headed Fishing Eagle.

Specimen not obtained.

Noted at: Periyār Lake (3,000 ft.) Travancore (at Thekaday and Camp Derāmalai ends).

Several of these fine eagles were observed at long intervals, perched singly on tall forest trees by the margin of the lake, or soaring and circling high up in its vicinity. The birds seemed to be rare and were shy and difficult to approach.

Stuart Baker (*Nidification*, iv, 84) says that Travancore birds are intermediate between the typical race and *plumbiceps* of Ceylon, but nearer the former.

Breeding: Stewart found the Grey-headed Fishing Eagle breeding in Travancore and took eggs on 2 March (*Nidification*, iv, 82).

Haliastur indus indus (Boddaert). The Brahminy Kite.

Specimens collected: 710 o? 23-7-33, 735 ♀, 736 ♀ 27-7-33 Beach, Trivandrum.

Elsewhere noted at: Thattakād (200 ft.); Kōttayam (ca. S.L.); Vembanād Lake; Alleppey; Kūmili (Periyār Lake 3,000 ft.); Tenmalai (500 ft.); Cape Comorin (ca. S.L.); Shoranūr; Chālakūdi; Wadakkāncheri (400 ft.); Nemmāra (300 ft.); Pādagiri (3,000 ft.); Karūpadanna (ca. S.L.); Ernākulam; Cochin Harbour.

Colours of bare parts: 'Iris yellowish-brown; bill horny black or dark plumbeous, yellowish at gape; mouth bluish-pink; legs and feet yellow; claws black' (Pillai).

[Additional specimens seen:

Brit. Mus. Coll.: ♂ ad. 25-3-77 Mynall (Bourdillon); ♀ ad. 28-2-75 Colachul (Hume Coll.).

Measurements:

	Bill.	Wing.	Tail.
1 ♂ ad.	38	359	180 mm.
2 ♀♀ ad.	33.5-36	379-391	189.5-200 mm.
1 ♀ imm.	33.5	378	197 mm.—H. W.]

The Brahminy Kite is a common resident species throughout the low country of Travancore and Cochin, and was also found locally and patchily

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on the hills up to at least 3,000 ft. It is commonest about the coast and backwaters, but was also noted as abundant at the Thekaday end of the Periyār Lake in the vicinity of the sluice gates. Numbers were usually to be seen here perched on the trunks and bare branches of the partly submerged trees. By the backwaters it lives chiefly by pilfering from the fish yards and on the large variety of garbage floating on the surface especially near the kopra depots and habitations, and in the harbours of Alleppey and Cochin. Mr. Pillai notes that one of the specimens had a number of tadpoles in its bill.

In the Nelliampathy Hills, Kinloch (*J.B.N.H.S.*, xxvii, 943) says that this kite only comes from the plains in fine weather as a temporary visitor, presumably not roosting on the heights. At Pādagiri, in the same hills, I observed 3 or 4 examples amongst a gathering of about 50 vultures at the scrappy remains of a Tahr that had been shot.

Both Fairbank and Terry include this species in their Palnis lists. The former found it abundant about tanks and ponds near the base of the Hills and observed it up to 4,000 ft. The latter saw a pair hawking about over the lake at Kōdaikānal.

The same race is a common resident in Ceylon.

Breeding: The gonads of the specimens (23 and 27 July) were in a quiescent state. In Travancore Bourdillon found most birds breeding in January and February (*Nidification*, iv, 87).

Milvus migrans govinda Sykes. The Common Pariah Kite.

Specimens not collected.

Noted at: Marāiyūr (3,500 ft.); Mūnnār (5,000 ft.); Sānthanpāra (3,500 ft.); Kōttayam (ca. S.L.); Peermade (3,200 ft.); Kūmili (3,000 ft.); Rājampāra (1,350 ft.); Tenmalai (500 ft.); Trivandrum; Cape Comorin; Arāmboli (250 ft.); Wadakkāncheri (400 ft.); Nemmāra (300 ft.); Pādagiri (3,000 ft.); Trichūr; Karūpadanna; Ernākulam; Cochin.

The Pariah Kite is common and generally distributed in the low country of Travancore and Cochin about towns and villages, and is also found on the hills (up to 5,000 ft.!) by human habitations. It is less dependent on the neighbourhood of water than the Brahminy Kite, but the two are commonly found in association.

A few birds were usually to be seen in the vicinity of coolie lines even in remote cardamom, tea and coffee plantations. Here they are great chicken robbers and a source of continual annoyance to the owners.

Near Pādagiri (ca. 3,500 ft.—Nelliampathy Hills) 3 or 4 Pariah Kites were noted amongst a gathering of about 50 vultures at the scanty remains of a Nilgiri Tahr. According to Kinloch (*J.B.N.H.S.*, xxvii, 943) it ascends these hills only as a daily visitor from the plains, and like the Brahminy Kite, does not roost up there.

Fairbank (*S.F.*, v, 392) found the Pariah Kite common at the base of the Palni Hills, but did not notice one above 3,000 ft. Terry (*S.F.*, x, 469) says that it is rather scarce on the tops of the Palnis, and that he never saw more than one or two pairs in the same place. It is common in Ceylon.

Breeding: In November and December breeding was in full swing in the low country of Cochin. The birds were observed in copula very generally, and on 29 December an individual was noted carrying building material into a cocoanut palm at the edge of the backwaters.

According to Ferguson (*J.B.N.H.S.*, xv, 670) in Travancore it usually breeds during February and March.

Elanus caeruleus vociferus (Latham). The Black-winged Kite.

Specimens collected: 186 ♂ 30-1-33 Sānthannāra 3,500 ft., Cardamom Hills.

Elsewhere noted at: Thattakād (200 ft.); Kūmili (3,000 ft.).

Colours of bare parts: Iris bright pale claret; bill horny black, cere and gape yellow; legs and feet yellow; claws horny black.

[The specimen ♂ measures:

Bill.	Wing.	Tail.	Tarsus.
22	273	124	30.5 mm.—H. W.]

In the experience of the Surveys, the Black-winged Kite is decidedly rare

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in Travancore and Cochin. Ferguson (*J.B.N.H.S.*, xv, 670) believed it to be only a winter visitor to Travancore. He had a specimen from Trivandrum and another from Sastancottah in the low country near Quilon, both killed in March. Kinloch (*J.B.N.H.S.*, xxvii, 943) considered it somewhat rare in the Nelliampathies, occasionally visiting the hills during the day and returning to the plains at night to roost. His remarks, however, do not suggest its seasonal status.

In Travancore it was met with singly in grassland and open deciduous and grass jungle, usually either perched on some favourite tree-stump or flying about with deliberate wing beats as of a Roller (*Coracias*) alternated with short spurts of sailing and hovering like a Kestrel. One of Ferguson's specimens had caught a lizard in its claws. Its food comprises mostly of these reptiles and of mice, locusts and grasshoppers.

Neither Fairbank nor Terry appear to have come across it in the Palni Hills. The same race is fairly well distributed in Ceylon.

Breeding: The gonads of the specimen (30 January) were inactive. No record of its breeding in Travancore or Cochin is available.

Circus macrourus (S. G. Gmelin). The Pale Harrier.

Specimen collected: 945 ♂ 5-12-33 Nemmāra 300 ft.

Elsewhere noted (this or *pygargus* ?): Marāiyūr (3,500 ft.); Peermade (3,200 ft.); Wadakkāncheri (400 ft.); Pādagiri (3,000 ft.).

Colours of bare parts: Iris greenish-yellow; cere and gape lemon yellow; rhampotheca horny black, plumbeous at base of lower mandible; mouth greyish-pink; legs and feet pale chrome yellow; claws black.

[Additional specimens seen:

Brit. Mus. Coll.: ♀ 28-12-75 Colathoorpolay Valley 3,000 ft. (Bourdillon); o? 22-2-14 Aneichardi Estate (Stewart).—H. W.]

The Pale Harrier is a winter visitor to Travancore and Cochin and found in the low country and hills alike. Ferguson (*J.B.N.H.S.*, xv, 671) obtained it at 6,000 ft. on the High Range. It frequents paddy cultivation, fallow land and the open hillsides as at Peermade, covered with grass tussocks intermingled with bracken bushes and stunted *Phoenix* palms. It quarters the ground on outspread motionless wings, sailing gracefully a few feet above the surface and pouncing now and then on some lizard, locust, mouse or frog.

It is a winter visitor also to Ceylon.

Circus pygargus Linnaeus. Montague's Harrier.

Specimen not obtained.

Noted (see under *macrourus*).

According to Ferguson (*J.B.N.H.S.*, xv, 671), Montague's Harrier is a winter visitor to the plains as well as hills of Travancore, arriving about a month later than the foregoing species, i.e. in December.

Circus melanoleucus (Pennant). The Pied Harrier.

Specimen collected: 83 ♂ 13-1-33 Marāiyūr 3,500 ft.

Elsewhere not noted.

Colours of bare parts: Iris bright lemon yellow; cere lemon yellow; rhampotheca horny back, plumbeous at gape and basal portion of lower mandible; mouth pinkish slate; legs and feet chrome yellow; claws black.

[Additional specimen seen:

Brit. Mus. Coll.: o? 18-4-77 Colathoorpolay Patnas 3,800 ft. (Bourdillon). —H. W.]

The Pied Harrier is evidently a scarce winter visitor to Travancore, and probably Cochin as well. There is, however, no record from the latter. The specimen was a solitary bird perched on a mound in a dry stubble field.

Ferguson (*J.B.N.H.S.*, xv, 671) says it visits Travancore occasionally, staying on later than the other harriers. He saw specimens in the beginning of April.

It is a rare winter visitor to Ceylon.

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Circus æruginosus æruginosus (Linn.). The Marsh Harrier.

Specimens collected: 304 ♀ 18-2-33 Kōttayam (Vembanād Backwaters).

Elsewhere noted at: Vellayāni Lake (near Trivandrum); Arāmboli (300 ft.); Nemmāra (300 ft.); Karūpadanna (backwaters).

Colours of bare parts: Iris hazel brown; cere yellow; rhampotheca horny black, plumbeous at gape and chin; legs and feet yellow; claws horny black.

The Marsh Harrier is, as Ferguson remarks (*J.B.N.H.S.*, xv, 671), the commonest harrier in Travancore during the cold weather, and to this I can add Cochin also. It is, however, confined to the low country where, as its name implies, it is found about water-logged paddy fields or shallow tanks with grass and reeds, and in the vicinity of the backwaters. It is almost invariably met with as a solitary bird. Ferguson found it in Travancore from October to April. The last date the Survey has recorded is 21 April.

It is a winter visitor also to Ceylon.

Buteo buteo burmanicus Hume. The Japanese Desert-Buzzard.

Not met with by the Surveys.

Ferguson (*J.B.N.H.S.*, xv, 671) states that he often saw these birds on the grass land at Pōnmūdi, but that the Trivandrum Museum possessed no specimens. Regarding a specimen collected in Travancore by F. W. Bourdillon and identified by Hume as *plumipes*, Mr. Whistler remarks (*J.B.N.H.S.*, xxxviii, 431) that this is, in reality, the smaller form *burmanicus* which is undoubtedly the one that visits south-west India in winter.

Bourdillon (*S.F.*, iv, 358) writes: 'This bird, a winter visitor, seems to be not uncommon during December, January and February, preferring high open country where 2 or 3 may be seen steadily quartering the ground and occasionally pouncing on some mouse or lizard. I have seen them perch both on trees and on stones, and once saw one as low as 2,000 ft. elevation, where it was beating forwards and backwards over a field of young coffee.'

This Buzzard is a winter visitor also to Ceylon.

Astur badius badius (Gmelin). The Ceylon Shikra.

Specimens collected: 423 ♀ 7-3-33 Kūmili 3,000 ft.; 555 ♀ ad., 556 o? and 557 o? downy chicks 10-4-33 Cape Comorin ca. S.L.; 776 ♀ 3-8-33 Kōvalam ca. 70 ft.—Trivandrum Environs.

Elsewhere noted at: Marāiyūr (3,500 ft.); Mūndakāyam (Ūrūmbikera Forest, ca. 1,000 ft.); Rājampāra (1,350 ft.); Wadakkāncheri (400 ft.); Nemmāra (300 ft.).

Colours of bare parts: *Adult* (♀): Iris bright yellow; cere greenish yellow, rhampotheca plumbeous, blackish on upper mandible except at base; legs and feet greenish yellow; claws horny black. *Downy nestling*: Iris greyish-brown; cere and gape creamy yellow; rhampotheca horny black, bluish-grey at base; mouth pink; tip of tongue blackish; legs and feet pale greenish-yellow; claws plumbeous.

[Additional specimens seen:

Brit. Mus. Coll.: ♂♂♀ no date Aneichardi Estate (Stewart).

Measurements:

	Bill.	Wing.	Tail.
3 ♂♂ ad.	20-20.5	172-180	128-131 mm.
4 ♀♀ ad.	22-23	186-206	149.5-161 mm.

Measurements include a Fry Collection bird without precise data.

Travancore birds are really intermediate between this and *dussumieri*, but in the Eastern Ghats Survey I have decided that it is better to keep them with *badius*.

Dr. C. B. Ticehurst reports on the down plumage as follows: 'Down short, dense, covering nearly all the body, apparently prepennae and preplumulae mixed. White below, buffy white above and on wings.'—H. W.]

The Ceylon Shikra is a common resident species in Travancore and Cochin, principally in the low country about villages and cultivation, but it was also met with by the Surveys up to about 3,500 ft. elevation in fairly open deciduous jungle. It avoids evergreen forest. It was not observed around Pādagiri

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(3,000 ft.), but was common at Nemmāra at the northern base of the Nelliampathies. Kinloch, however, lists it as 'common' on these hills (*J.B.N.H.S.*, xxvii, 943).

Neither Fairbank nor Terry record it in the Palni Hills. It is a common resident also in Ceylon.

Breeding: Nos. 556 and 557 (10 April) were downy nestlings and 555—with ovaries reverting to non-breeding condition (follicles ca. 1-1.5 mm.)—their mother. The nest was built of twigs etc.—very like a crow's at the base of the leaf-stalks in a *Borassus* palm amidst sparse scrub and cultivated country. The owners beat off crows and other birds from its proximity, but made no effort at defence when the nest was climbed up to. From the behaviour of other pairs also, it was evident that the birds were breeding generally at this time.

According to Bourdillon the season in Travancore is January to April, the normal clutch comprising of 3 to 4 eggs. Stewart found the birds commonly building in rubber trees in rubber estates. Kinloch took eggs on the Nelliampathy Hills on 27 March (*Nidification*, iv, 102).

Astur trivirgatus trivirgatus (Temm. & Lang.). The Crested Goshawk.

Not met with (overlooked?) by the Surveys.

Ferguson (*J.B.N.H.S.*, xv, 672) describes the Crested Goshawk as resident but by no means common in Travancore. Kinloch (*J.B.N.H.S.*, xxvii, 943) seems to have found the species common in the Nelliampathy Hills. His identification is confirmed by a specimen he collected in December 1923 and sent to Mr. Whistler.

It is said to affect heavy jungle (F. W. Bourdillon, *S.F.*, iv, 355).

Breeding: According to Stewart and Bourdillon (*Nidification*, iv, 107) this hawk breeds in Travancore from the foothills up to 3,000 or 3,500 ft. They have taken eggs—c/2 or c/3—from 2 March to 25 May, the latter being an unusually late date. On 14 April, Bourdillon found a nest at Mynall containing two juvenile birds.

Accipiter nisus nisosimilis (Tickell). The Asiatic Sparrow-Hawk.

Not met with by the Surveys.

Ferguson (*J.B.N.H.S.*, xv, 672) lists this species as a rare winter visitor to Travancore. He mentions F. W. Bourdillon securing a single specimen on the hills (Mynall 2,400 ft., *S.F.*, vii, 33). This—an immature ♀—is now in the British Museum Collection.

Mr. Whistler has also examined the only other Travancore specimen in the British Museum—an immature ♂—collected by Fry.

Accipiter virgatus besra Jerdon. The Southern Besra Sparrow-Hawk.

Specimen not obtained.

Noted at Pādagiri (3,000 ft.—Nelliampathy Hills).

Ferguson does not include this species in his Travancore list, but Stuart Baker, evidently on the authority of J. Stewart, says (*Nidification*, iv, 112-13) that it is common in Travancore and on the Malabar Coast, but seems to be rare elsewhere. It is described as a bird of deep evergreen forest from 2,000 to 4,000 ft. elevation or higher.

Kinloch (*J.B.N.H.S.*, xxvii, 943) found it 'very common' in the Nelliampathy Hills, where the Cochin Survey also came across it on two occasions. Solitary birds were observed perched on tall dead trees on the verge of evergreen jungle.

The same race occurs also in Ceylon.

Breeding: According to *Nidification*, Stewart took nests and eggs of this Sparrow-Hawk in Travancore between January and May. Most eggs were found in March and April. The normal clutch consists of 3 or 4 eggs.

Pernis ptilorhynchus ruficollis Lesson. The Indian Crested Honey-Buzzard.

Specimen not obtained.

Noted at: Sānthanpāra (3,500 ft.—Cardamom Hills); Peermade (3,200 ft.); Kūmili and Perivār Lake Environs (3,000 ft.); Camp Derāmalai (3,000 ft.—Panthalam Hills); Rājampāra (1,350 ft.); Tenmalai (500 ft.); Arāmboli (250 ft.); Bālamore Estate (2,000-3,000 ft.—Ashāmbū Hills).

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The Honey-Buzzard was not uncommon in the well-wooded tracts of Travancore State, but not abundant. Usually single birds were observed soaring or circling above sholas. It has a high-pitched, rather prolonged whistling scream *wheew*.

Ferguson (*J.B.N.H.S.*, xv, 672) secured a single specimen at 'Peermade' near the Periyār Dam in January 1901, and considered the species a rare winter visitor to Travancore. Its status, however, has apparently not been properly determined.

Kinloch does not include the Honey-Buzzard in his Nelliampathies list, and strangely enough the Survey likewise failed to record it in Cochin during November and December.

It is found in Ceylon possibly as an immigrant, but its status in the island is also uncertain.

Baza leuphotes leuphotes (Dumont). The Indian Black-crested Baza.

Not met with by the Surveys.

Mr. Whistler has examined a specimen in the British Museum, collected by Stewart in Aneichardi Estate, Travancore, on 19 February 1914.

Breeding: According to *Nidification* (iv, 120) Stewart obtained nests of this species frequently at 2,000-2,500 ft. elevation in Travancore. He took most eggs in March and April—as early as 10 February and also as late as 4 July. The normal is said to be c/2 or c/3.

Baza jerdoni ceylonensis Legge. Legge's Baza.

Not met with by the Surveys.

Stewart, the only observer to record this species in Travancore, states (*Fauna*, v, 176) that it is rare and difficult to locate.

Breeding: The same observer is credited (*ibid.*, 175) with having taken nests and a very fine series of eggs of this Baza in Travancore. According to him, the breeding season in this area is from February to the end of April, the normal clutch consisting of 2 or 3 eggs.

ORDER: COLUMBÆ.

FAMILY: COLUMBIDÆ.

SUBFAMILY: TRERONINÆ.

Crocopus phœnicopterus chlorigaster (Blyth). The Southern Green Pigeon.

Not noted by the Surveys.

The Southern Green Pigeon was evidently not observed by Ferguson either in Travancore. There is no information concerning it in this area beyond that given below under 'Breeding', and it must be pointed out that no Travancore specimens are available for examination, which makes the use of the trinomial somewhat conjectural.

In the Nelliampathy Hills, Kinloch (*J.B.N.H.S.*, xxvii, 943) describes this species as very common in October, November and December. Its exodus from those hills begins about the middle of January and none are to be seen after the middle of February. Occasionally, however, a few birds remain behind to breed.

Fairbank (*S.F.*, v, 408) obtained this Green Pigeon in the avenues near the northern base of the Palni Hills. Terry (*S.F.*, x, 479) took a nest with one fresh egg in the Pittur Valley on 7 April, but did not meet with the species at higher elevations.

Breeding: *Nidification* (iv, 127) records the taking of its eggs in Travancore by Stewart in January.

Dendrophassa pompadora affinis (Jerdon). The Grey-fronted Green Pigeon.

Specimens collected: 401 ♂ 5-3-33 Kūmili 3,000 ft.; 644 ♂ 23-4-33 Balamore Estate 2,500 ft.—Ashāmbū Hills; 687 ♂ 18-7-33 Pūlayanārkotta ca. 200 ft.—Trivandrum Environs.

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Elsewhere noted and/or shot at: Sānthanpāra (3,500 ft.—Cardamom Hills); Thattakād (200 ft.); Peermade (3,200 ft.); Wadakkāncheri (400 ft.); Pādagiri (3,000 ft.—Nelliampathy Hills).

Colours of bare parts: Iris, outer ring bright pink, inner ring lapis blue; bill, cere and lower mandible near gape yellowish-green rest pale grey; mouth yellowish grey-pink; legs and feet dull magenta or plum colour ('Deep red'—Pillai); claws horny grey; soles yellow.

[Additional specimens seen:

Brit. Mus. Coll.: ♂ 13-12-78 Mynall (Bourdillon); ♂ 7-1-73 Assambo Hills (Hume Coll.).

Sparrow Coll.: ♂ 20-3-14 Cardamom Hills.

Measurements:

	Bill.	Wing.	Tail.	Tarsus.
4 ♂♂	19-20	143.5-147	88	20-23 mm.—H. W.]

The Grey-fronted Green Pigeon is a common species in the well-wooded portions of the low country of Travancore and Cochin, and extends through the foothills upward to at least 4,000 ft. elevation. It is said to be an altitudinal migrant to some extent. Kinloch (*J.B.N.H.S.*, xxvii, 943) states that in the Nelliampathy Hills it becomes increasingly common as *chlorogaster* becomes scarce; it is extremely common there during February and March, but that it also goes down to the low country before the burst of the South-West Monsoon.

The Surveys usually came across the birds in small flocks of up to a dozen or so. When not feeding they are fond of perching on dead or leafless trees on the edge of jungle and uttering their mellow whistling calls.

In the Palni Hills, Fairbank (*S.F.*, v, 408) obtained specimens of this Green Pigeon at Periur, where flocks came to feed on ripening *Zizyphus* fruits.

The typical race is abundant in Ceylon up to 4,000 ft.

Breeding: A female shot on 18 December at Pādagiri had a complete oviduct egg and the largest ovarian follicles measuring 12 mm. in diameter. In these hills Kinloch records this species as breeding solely in January and February.

Specimen No. 401 (5 March) was also breeding as evidenced by the testes which had enlarged to 13×7 mm.

T. F. Bourdillon found a nest with one egg in the Ashāmbū Hills at 2,400 ft. on 24 February.

Dendrophassa bicincta subsp.? The Orange-breasted Green Pigeon.

Not met with by the Surveys.

Ferguson (*J.B.N.H.S.*, xvi, 1) says that this species is by no means as common in Travancore as the foregoing, but that it may be met with in the low country forest not far from the coast.

In Ceylon it is replaced as a common coastal species by *D. b. leggei*.

Breeding: *Nidification* (iv, 131) records that Stewart found breeding in Travancore birds which almost certainly belonged to the Ceylonese race. It is perhaps preferable, however, to keep this binomial for the present in view of the difficulty explained by Mr. Whistler (*J.B.N.H.S.*, xxxviii, 673-4) over the correct names of the races of this bird. No specimens are available from the typical locality to show to which form the typical name should be rightly applied.

Ducula badia cuprea (Jerdon). Jerdon's Imperial Pigeon.

Specimen collected: 409 ♀ 6-3-33 Kūmili 3,000 ft.

Elsewhere shot and/or noted at: Sānthanpāra (3,500 ft.); Thattakād (200 ft.); Peermade (3,200 ft.); Camp Derāmalai (3,000 ft.); Rājampāra (1,350 ft.); Tenmalai (500 ft.); Balamore Estate and Mūthūkūzhi (between 2,500 and 4,000 ft.—Ashāmbū Hills); between Kūvallé Incline and Kūriārkūtti (Cochin Forest Tramway); Pādagiri (3,000 ft.).

Colours of bare parts: Iris brown; eyelids magenta; bill magenta except corneous tip which horny brown; legs and feet magenta; claws like tip of bill.

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[Additional specimens seen: 7 specimens (November-December, January-March) Mynall (Bourdillon) in British Museum.
Sparrow Coll.: ♀ 9-3-14 Cardamom Hills.

Measurements:

	Bill.	Wing.	Tail.	Tarsus.
2 ♂♂	32	221-228	—	—
7 ♀♀	30-33.5	225-235	164-174.5	29.5-31 mm.—H. W.]

Jerdon's Imperial Pigeon is a common resident species in the evergreen biotope of Travancore and Cochin. It was met with chiefly in the heavily forested foothills, and in wooded ravines and sholas at elevations up to at least 4,000 ft. It was usually observed singly or in pairs—occasionally 3 or 4 birds together. Its loud, throaty, booming calls *gu-gu- - -goo* and *goo-goo-goo*, rising in crescendo, commonly resounded through the forest. In timbre and volume these may be placed between the call of the Crow Pheasant and that of the *Entellus* or Langūr Monkey.

This Pigeon has evidently not been recorded in the Palni Hills though it must doubtless occur there. It has doubtfully been recorded as breeding in Ceylon.

Breeding: The specimen (16 March) was ready to breed shortly. Its ovary was mature, the largest follicle measuring over 7 mm. in diameter. On 16 March (Camp Derāmalāi) two twig nests, about 30 ft. apart, were noted in a large Ficus tree about 25 ft. up, within a mixed shola, off which the sitting birds were disturbed. From the general behaviour of the pigeons about this time, breeding was undoubtedly in full swing. On one occasion, a remarkable display of antics were observed. A bird—presumably male—launched itself into the air from a lofty branch. After flying some distance it suddenly closed its wings, and utilising the momentum shot upwards almost perpendicularly for 30 ft. or so. On the crest of the wave, as it were, the bird turned round and nose-dived, wings still closed. When back to about its former level, it flew a few yards more horizontally with great velocity and then suddenly closing its wings repeated the manoeuvre again. These acrobatics were reminiscent of the breeding display of the Roller (*Coracias*), but were infinitely more spectacular.

According to Stewart and Bourdillon (*Nidification*, iv, 139) the breeding season in Travancore is January to May. The latter says that it has two broods a year—in April and again in November. Only one egg is said to be laid at a time.

Muscadivora ænea pusilla (Blyth). The Ceylon Imperial Green Pigeon.

Specimen not obtained.
Noted at Thattakād (200 ft.).

[The only Travancore specimen I have examined is an unsexed 'Anjengo' skin in the British Museum. Bill 31; wing 210 mm.—H. W.]

According to Ferguson (*J.B.N.H.S.*, xvi, 2) this fine pigeon is only found in the low country forests in Travancore, and he is doubtless correct. The Travancore Survey only came across it at Thattakād, where it was not uncommon in the mixed deciduous-and-evergreen jungle.

It was not met with by the Cochin Survey. Kinloch (*J.B.N.H.S.*, xxvii, 943) describes it as rare in the Nelliampathy Hills and occurring only towards the foot of the Southern slopes. He thought it may probably be common in the immense forests of the Nelliampathy Valley.

Fairbank and Terry do not record it in the Palni Hills. It is apparently a common resident in Ceylon.

Breeding: Stewart and Bourdillon took many nests and eggs in Travancore in February, March, April and June (*Nidification*, iv, 142).

Chalcophaps indica indica (Linn.). The Indian Emerald Dove.

Specimens collected: 9 ♂ 4-1-33 Marāiyūr 3,500 ft.; 987 ♂ juv. 16-12-33 Pādagiri (at 4,000 ft.).

Elsewhere noted at: Sānthanpāra (3,500 ft.); Thattakād (200 ft.); Peermade (3,200 ft.); Camp Derāmalai (3,000 ft.); Rājampāra (1,350 ft.); Tenmalai (500 ft.); Balamore Estate (2,000-3,000 ft.); Kūriārkūtti (1,600 ft.).

Colours of bare parts: *Adult*: Iris brown; bill coral red, magenta on cere; legs and feet pinkish red; claws horny-brown. *Juvenile*: Iris brown; bill slaty

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brown with ivory tip; orbital skin slaty brown; mouth pink; legs and feet pinkish-grey; claws horny brown.

[Additional specimens examined:
Brit. Mus. Coll.: ♂ 29-2-76, ♀ 2-11-78, ♀ 14-1-76 Mynall 2,400 ft. (Bourdillon); also 2 Peermade skins no date (Fry).

Measurements:

	Bill.	Wing.
4 ♂♂	21-23.5	153-157 mm.

The juvenile of both sexes resembles the adult female, but the green is confined to the mantle and a broad band across the median and lesser wing coverts; the green is duller without any trace of blue in it, the feathers are more 'decomposed' and some are tipped with a band of rufous brown. Remainder of coverts and wing-quills dark brown, most of the feathers edged and tipped and with their inner web marked with rufous brown, some of the inner coverts being largely of this colour. Lower plumage, except for the pale chin and throat, uniform brown, darker than in the adult, the feathers faintly vermiculated and narrowly barred with dull black, especially on the breast and flanks. Under tail coverts black.—H. W.]

The Surveys found the Emerald Dove common in the forested tracts of Travancore and Cochin, both in the low and foothills country as well as up to about 4,000 ft. in the hills. The birds were almost invariably seen singly or in pairs, feeding on the ground along paths or roads through jungle and coffee or cardamom plantations. At Marāiyūr they were noted as partial to the Castor plants which spring up so luxuriantly in old abandoned taungya clearings, amongst whose branches they were almost invariably to be met.

Specimen No. 9 was a casualty caused by impact of the bird dashing itself against the whitewashed wall of a building. I was told that Bronze-winged Doves here were constantly coming to grief in this way and numbers had been picked up from time to time lying dead at the foot of this wall. The birds, flying as they do at great speed, no doubt take the sunlit patches of this wall (as seen through the dense surrounding shrubbery) to be the open sky and rush towards it with fatal results to themselves.

In the Palni Hills the status of the Emerald Dove is probably the same as in our area. Fairbank (*S.F.*, v, 409) shot one and saw another at Periur and Terry (*S.F.*, x, 479) obtained a specimen at Pulungi.

In Ceylon the endemic race *C. i. robinsoni* is generally distributed.

Breeding: The testes of the adult specimen (4 January) measured 6×4 mm. 987 (16 December) was a juvenile just growing rectrices, remiges and contour feathers. It was one of a brood of two, out of nest, in a dense evergreen patch in a ravine at ca. 4,500 ft. elevation. The young birds flew up noiselessly from the ground, in and out through cane brakes etc., settling again at a short distance, remarkably like a nightjar. Indeed in the poor light and amidst the dense vegetation they were at first actually mistaken for that bird!

Bourdillon says that in Travancore this dove breeds in April-May and again in November-December, and Kinloch found the same to be the case on the Nelliampathy Hills (*Nidification*, iv, 147).

Subfamily: Columbinæ.

Columba livia intermedia (Strickland). The Indian Blue Rock Pigeon.

Specimens not collected. No Travancore or Cochin specimens have been available to Mr. Whistler for examination, hence the trinomial is merely conjectural.

Noted at: Marāiyūr (3,500 ft.); Cape Comorin, Arāmboli (250 ft.); Wadakkāncheri (400 ft.); Karūpadanna (ca. S.L.).

Most of the Blue Rock Pigeons met with in Travancore and Cochin were in all probability tame or semi-domesticated birds. They were usually observed

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gleaning in cut paddy fields etc. in the vicinity of villages but were nowhere common or abundant.

A small colony living in the ceiling and among the rafters of the outhouses of the Travellers' Bungalow at Karūpadanna provided the Survey party with the welcome change of Pigeon-pie on several occasions!

According to Ferguson (*J.B.N.H.S.*, xvi, 2) during the dry months these pigeons ascend the hills up to 2,500 ft. elevation in South Travancore, feeding there during the day and returning in the evening to their roosting places in the low country. The colony referred to by Ferguson in 1904 on the rock that rises out of the sea at Cape Comorin, was observed to be in occupation still (1933).

Fairbank (*S.F.*, v, 408) did not find this species abundant on the Palni Hills. He observed a flock by the fall of Levinge's brook. Terry (*S.F.*, x, 479) records a large colony on the cliffs near Pittur.

It has a very local distribution in Ceylon.

Breeding: Nothing appears to be recorded about the season in our area.

Columba elphinstonii (Sykes). The Nilgiri Wood Pigeon.

Specimens collected: 60 ♂ 10-1-33 Marāiyūr 3,500 ft.; 146 o? 24-1-33 Sānthanpāra 3,500 ft.

Elsewhere noted at: Thattakād (200 ft.).

Colours of bare parts: Iris (60) bright khaki, (146) pale khaki or greyish-brown; bill, basal half including cere magenta; corneous portion old ivory white; mouth greyish-pink; legs and feet magenta; claws greyish ivory-white.

[Additional specimens examined:

Brit. Mus. Coll.: ♂♀ 22-6-77, ♀ 23-6-77 Kodaikanal 7,000 ft. (Fairbank); ♀ 28-9-74, ♂ imm. 5-10-74 Mynall (Bourdillon).

Measurements:

	Bill.	Wing.	Tail.
1 ♂	27	203	—
1 ♀	27	202	158 mm.

No. 146 appears to be in juvenile plumage, similar to that of the adult but with the neck-spotting duller, less clearly defined.—H. W.]

The Nilgiri Wood Pigeon was not uncommon in the evergreen forest tracts of Travancore, chiefly in the hills but also lower down, e.g. Thattakād (200 ft.). Single birds or pairs were met with amongst tall trees in forest and cardamom sholas.

Ferguson (*J.B.N.H.S.*, xvi, 3) found it common at the summits of the hills in South Travancore and at Peermade, and also on the High Range. Kinloch does not include this pigeon in his Nelliampathies list (*J.B.N.H.S.*, xxvii), but in *The Birds of South India* he is quoted as having found it sparingly in those hills.

In the Palnis, Fairbank (*S.F.*, v, 408) obtained it both in the Kodaikanal at 7,000 ft. and on the lower hills at 4,000 ft. Terry (*S.F.*, x, 479) describes it as common in most of the big sholas there.

In Ceylon it is replaced by another species, *C. torringtonii*.

Breeding: The gonads of the specimens furnished no clue in regard to breeding. According to Stewart (*Nidification*, iv, 155) this pigeon breeds in the Travancore ranges from 4,000 ft. up. He only once took an egg, but omits to give the date.

Capt. Horace Terry obtained a nest with one egg at Kukal in the Palni Hills on 17 May. *Nidification* (iv, 154) gives the general breeding season as from March to July, most eggs being laid in May and June.

Streptopelia chinensis suratensis (Gmelin). The Indian Spotted Dove.

Specimens collected: 695 ♂ 20-7-33 (Thirūmalai ca. 120 ft.), 858 ♂ downy nestling, 859 o? downy nestling (nest twin of 858) 2-8-33 (Golf Links ca. 100 ft.) Trivandrum Environs.

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Elsewhere noted at: Marāiyūr (3,500 ft.); Sānthanpāra (3,500 ft.); Thattakād (200 ft.); Kōttayam (ca. S.L.); Kūmili (3,000 ft.); Kājampara (1,350 ft.); Cape Comorin; Arāmboli (250 ft.); Wadakkāncheri (400 ft.); Nemmara (300 ft.); Karūpadanna (ca. S.L.).

Colours of bare parts: '*Adult*: Iris claret; bill horny black; mouth slaty; legs and feet red; claws horny brown. *Nestling*: Iris bluish black; bill upper mandible slaty, darker near tip, whitish near base; lower mandible horny black tipped brownish-white; legs and feet brownish-black; claws horny brown, tipped paler'—(Pillai).

[Additional specimens examined:

Brit. Mus. Coll.: ♂ 15-6-77 Periur, Lower Palnis, 4,000 ft. (Fairbank); o? 21-6-77 Vellarney Lake (Hume Coll.).

Measurements:

	Bill.	Wing.
2 ♂♂	18-19	139-140 mm.

A note on the moult of this race will be found in *Ibis*, 1935, p. 437.—H. W.]

The Spotted Dove is a common and resident species in Travancore and Cochin. It was met with both in the low country and on the hills up to about 3,500 ft. elevation, but was noted as definitely absent at Mūnnār (5,000 ft. High Range). According to Ferguson (*J.B.N.H.S.*, xvi, 3), however, it ascends the hills in the dry weather only. In most of the localities mentioned, it was the only species of dove to occur. The birds were usually observed in pairs, in the neighbourhood of cultivation and human habitations, gleaning seeds and paddy grains in harvested fields and on fallow land.

Kinloch's Nelliampathies list does not include this dove, and the Cochin Survey also failed to observe it at Pādagiri (3,000 ft.) on these hills during December.

Both Fairbank and Terry (*S.F.*, v, 409 and x, 479) say that it is very common in the Palnis, on the lower hills as well as at the base, especially near villages.

In Ceylon, the endemic race *S. c. ceylonensis* replaces it and is abundant up to 3,000 ft. elevation.

Breeding: On 6 December (Nemmāra) a nest was discovered on a horizontal teak branch ca. 16 ft. up, in open deciduous forest, containing 1 egg and 1 chick just hatched out. On 10 January (Marāiyūr) a pair were observed in copula. The testes of No. 695 (20 July) measured 7×5 mm. On 2 August Mr. Pillai saw a nest ca. 5 ft. up on a beam supporting creepers in a garden at the Trivandrum Golf Links. It was the usual flimsy 'two cross-twig' platform, and contained 2 eggs. The downy specimens were taken from another nest on the same date.

According to Bourdillon (*J.B.N.H.S.*, xvi, 3) in Travancore the Spotted Dove has 2 or 3 broods in the year. It would perhaps be more correct to say that it breeds here more or less all the year round.

Terry (*S.F.*, x, 479) obtained a nest with two eggs at Pittur in the Palni Hills at the end of April.

Streptopelia senegalensis cambayensis (Gmelin). The Indian Little Brown Dove.

Specimen not collected.

Noted only at Arāmboli in dry open country with boulder hillocks, cactus and sparse scrub. Here it was noticeably commoner than the Ring or Spotted Dove, but not abundant.

Ferguson says about it (*J.B.N.H.S.*, xvi, 3) '. . . by no means common and is only to be found in the dry region of the extreme South [of Travancore] not far from Cape Comorin.'

In the Palnis Fairbank (*S.F.*, v, 408) observed it at the base of the hills and on the lower hills, while Terry (*S.F.*, x, 479) records it from the slopes below Pulungi and in the Pittur Valley, where it is not common.

It does not occur in Ceylon.

Breeding: There is no published record of its breeding in Travancore or Cochin.

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Streptopelia decaocto decaocto (Frivalsky). The Indian Ring Dove.

Specimen not obtained.

Noted only at Cape Comorin and Arāmboli, frequenting scrub and boulder country with scattered cultivation. It was decidedly rare.

In the Palnis, Fairbank (*S.F.*, v, 409) found it in the plains, presumably at the base of the hills, and Terry (*S.F.*, x, 479) in the Pittur Valley, but they both mention that it is not common.

It has a local distribution in North-West Ceylon.

Breeding: No information with regard to its breeding in our area is available.

(To be continued).

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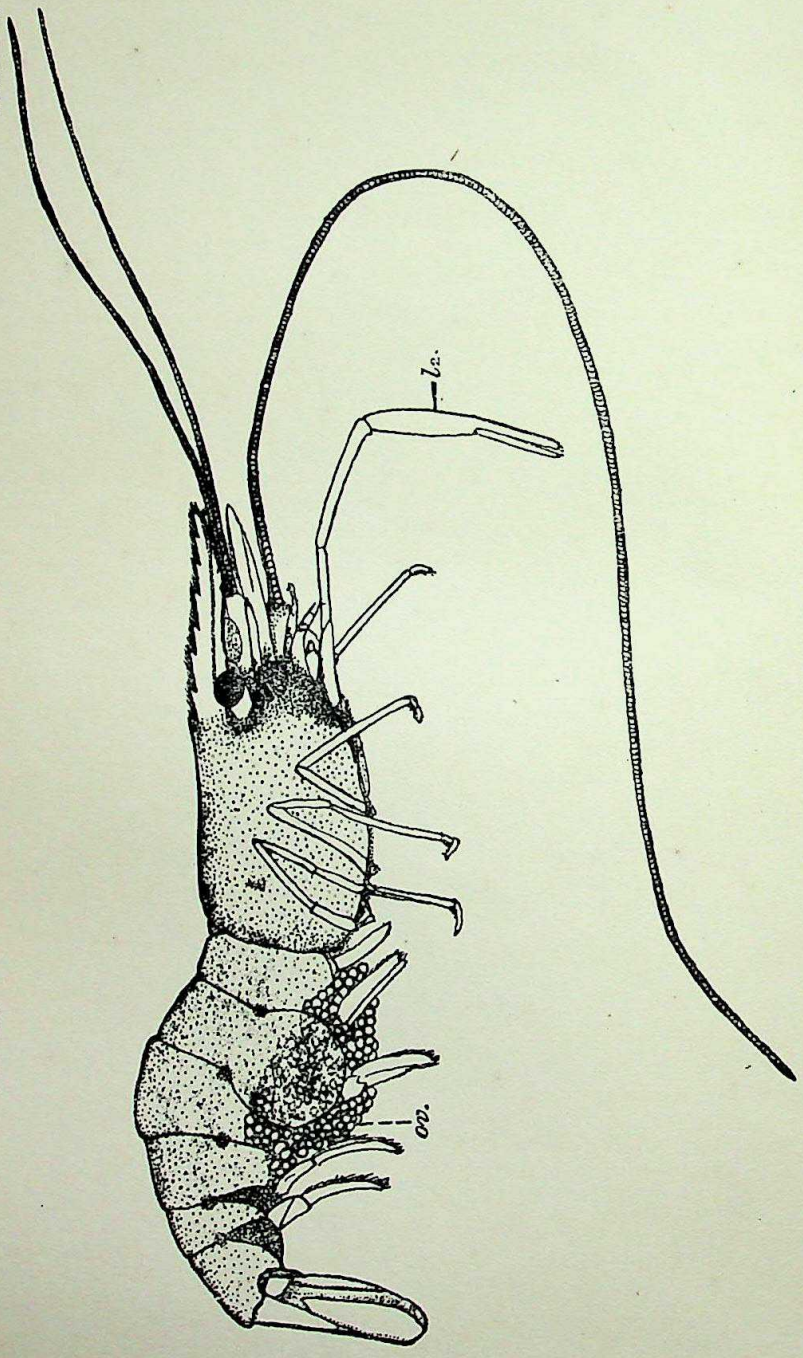

An ovigerous female of *Palaemon* sp.

For explanation see end of article.

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THE PRAWN INDUSTRY OF THE MALABAR COAST.

BY

[1]N. KESAVA PANIKKAR, M.A., M.SC.

(*With three plates*).

INTRODUCTION.

Though the resources of the prawn fisheries of the backwaters adjoining the south-west coast of India have been realized by the people long ago, only very recently have attempts been made to take the best advantage of the highly favourable physical and biological conditions enabling the culture of edible prawns on a large scale. As fresh prawns have a ready local market, they are caught and sold at random wherever they are available, and only in a few localities do we find prawn fishing conducted on an industrial basis, allowing of regular exports to other places. The importance of the industry has been realized only by a few even in these days and there is much to be done for the betterment of the existing conditions. There is excellent scope for prawn culture and prawn fishing in Malabar and the States of Travancore and Cochin; with properly planned marketing facilities, this will become an important commercial occupation as on the Bombay and Sindh coasts, if proper attention be paid both by the governments concerned and by the people. It will be well worth our while to examine the different aspects of an industry so full of promise. This study is made with particular reference to the conditions in Travancore, in order to compare them with those of the prawn fisheries of the Bombay Presidency, an excellent survey of which was recently conducted by Mr. H. S. Rai, under the auspices of the Bombay Natural History Society.[2]

GENERAL CONSIDERATIONS.

As is well known, the geography of Travancore is peculiar in having a large number of backwaters bordering the coast-line, into which open the many hill-streams from the Western Ghats. On the whole, the backwaters occupy an area of about 180 sq. miles. The chain of backwaters is separated from the sea by a narrow strip of land, composed of sand and black clay or silt, and varying from about ten miles to half a mile in width; and often the two come so close that only the sandy beach separates them. There are also frequent communications between the sea and the

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[1] I wish to thank Messrs. N. P. Auseph, M. R. Panikkar and G. R. Menon for much valuable information, Dr. N. P. Panikkar and Mr. Auseph for some of the photographs, and Prof. R. Gopala Aiyar for helpful suggestions.

[2] Rai, H. S., 'Shell Fisheries of the Bombay Presidency', Part II, *Journ., Bombay Nat. Hist. Soc.*, vol. xxxvi (1933).

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backwaters; either they are permanent openings allowing free admixture of salt and fresh-water, as at Neendakara and Cochin, or they are only periodical openings, allowing a flow of water from one to the other only during certain seasons of the year, as at Paravoor, Kayenculam, etc. In several places, the sand bank separating the sea and the backwater is so shallow as to allow the water to flow from the sea into the backwater during high tide. Owing to these factors and the 'brine percolation' throughout the coast, the backwaters contribute to the formation of characteristic brackish-water zones extending over a wide area in association with the low-lying lands, paddy-fields and the net-work of canals. During the South-West Monsoon, from June to September, the backwaters are in a flooded condition as the amount of water brought down by the rivers is immense and, at this time of the year, the water in them is almost fresh. The level of the water considerably falls after the North-east Monsoon, during November, when the secondary maximum period of rainfall is passed. A month hence, the water in the backwaters is distinctly brackish. The optimum conditions for the life of brackish-water animals are obtained from January to March. Though the salinity is slightly higher in the succeeding months of April and May, the conditions are unfavourable as most of the shallow regions dry up during this period.

As the paddy fields have an important rôle in prawn-fishing operations, some of the relevant details about these may be included here. There are usually two periods of paddy crops, one from December to March and the other from July to October. Prawn fishing is mostly carried on in the paddy fields; hence the prawn season corresponds to the period when the fields are uncultivated. In those parts of North Travancore where this industry has developed to a certain extent, the paddy fields adjoining the backwaters, *Pokkali fields* as they are called, are cultivated only once in the year, and that during July—October, unlike the fields far off (*Punja* and *Virupu fields*) which may annually yield two paddy crops and an intervening crop of pulses and vegetables. Prawn fishing is carried on an industrial basis only in Pokkali fields that remain uncultivated for the major part of the year. In southern and middle Travancore, the December-March period is the one in practice, though in many places, where the fields are on a higher level, there may also be a supplementary crop during the Monsoon.

The Prawns of Travancore.

The prawns that inhabit the backwaters include three groups of species: (1) brackish-water species which have made the backwater more or less their permanent home; (2) marine euryhaline species which periodically migrate into the backwater; and (3) migrants from freshwater to the brackish-water. The distinction between the first and the second groups is not easy as some of the marine prawns exhibit remarkable capabilities of adjustment and have a simultaneous distribution along the sea coast as well as in the coastal backwaters. Many of them are periodical migrants

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that live in the brackish water during their early and juvenile stages. Much remains to be known of the migratory habits of these prawns, but it has been observed in several places that the *Penacid* prawns, which unlike most other Decapod Crustacea hatch out at an early developmental stage as tiny pelagic nauplii, enter the backwaters as young ones, and grow there for about an year, after which they go back to the sea to breed.[1] [2] It is highly probable that the conditions in the brackish-waters at the mouths of rivers and adjoining backwaters where a large amount of organic matter is brought down, being rich in food supply, afford optimum conditions for the quick growth of young prawns. In many of these species, acclimatisation for brackish-water life is only partial. Though inhabiting the backwaters during a phase of their life history, they are apparently unable to breed and propagate there. It may be that the sexually ripe individuals and early larvae are not able to survive low salinity conditions, and that the peculiar brackish-water environment is not conducive to the proper development and dehiscence of sexual products.

Of the three groups above enumerated, the first and the second are of greater commercial importance than the third, as fresh-water prawns have only a local sale in the fresh state. They comprise the species of *Penaeus*, *Penaeopsis* and *Parapenaeopsis* among the *Penaeidae*, and of *Leander* among the *Palaemonidae*. Rai observes that the most abundant species on the Bombay coasts are *Penaeus semisulcatus* de Haan, *Penaeopsis monoceros* (Fabr.) and *Leander styliferus* (M. Edw.). The common species of the Travancore coasts are *Penaeus indicus* M. Ed., *P. carinatus* Dana, *P. semisulcatus* de Haan, *Penaeopsis monoceros* (Fabr.), *P. dobsoni* (Miers), *P. lysianassa* (De Man), and *Parapenaeopsis stylifera* (M. Ed.). It is probable that the numerous other species recorded from other parts of India are also present here since many of them have a wide distribution in the Indo-Malayan coasts.[3] The fishing season for common prawns begins with the month of November and extends to about the close of March. This statement applies only to those localities in North Travancore where prawn-fishing has assumed something of the nature of an industry.

A few observations on the biology of brackish-water prawns may be included here. Adults of *Penaeids*, especially of *P. carinatus* and *P. indicus*, are beautifully coloured. The former is a deeply pigmented species, varying in shade from bluish brown to dark grey, with dark transverse bars on the abdomen, and bright yellow markings at the bases of the pleopods. *P. indicus* is pink with numerous red patches on the body. In both these

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[1] Kemp, Stanley, 'Crustacea Decapoda', in the Fauna of the Chilka Lake, *Mem. Ind. Mus.*, vol. v (1915).

[2] Dakin, W. J., 'Presidential Address', *Proc. Linn. Soc., New South Wales*, vol. lx, p. xxvii (1935).

[3] *Vide* Alcock, A., *Catalogue of the Indian Decapoda Crustacea in the Collection of the Indian Museum*, Part III, Fasc. i; Henderson, J. R., *Trans. Linn. Soc.*, vol. v, ser. ii (1893); De Man, *Siboga Expeditie*, vol. xxxix, Part I (1911); and Kemp, S., *Mem. Ind. Mus.*, vol. v, (1915).

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species, the deep pigmentation is observed only in fully-grown individuals. *Penaeopsis monoceros* and *P. dobsoni* are somewhat semi-transparent when alive. Specimens of all these species turn red in alcohol or formalin.

The young prawns found in the backwaters always prefer a muddy bottom for their habitat. The question of their food habits needs much further elucidation; they appear to subsist mainly on algae at least in a few places investigated in detail by the author. Some of the larger fish found in the backwaters prey upon young prawns. Nothing is known of their moulting, but as will be shown later, their growth appears to be fairly rapid.

The freshwater prawns comprising the third group include several species of *Palaemon* which migrate into the backwaters when the latter have a low salinity. *Palaemon carcinus* Fabr. which grows to a large size is the common popular freshwater prawn of Travancore. The other species include *P. idae* Heller, *P. scabriculus* Heller, *P. sulcatus* Hend & Math., and *P. dolichodactylus* Hilgendorf.[1] Specimens of *P. carcinus* are available in large numbers in the lower reaches of most of the rivers; the season is from September to December; and an inquiry in the markets of Kottayam and other neighbouring places reveals that the largest specimens are obtained in the month of November. It is believed that the migratory individuals of *P. carcinus* are mostly the 'berried females', as judged by the proportion of sexes in fresh- and brackish-water. Henderson and Mathai[2] obtained both adult females and males from the brackish-waters near Cochin, and they state that this is the only species of *Palaemon* which they have met with in salt-water. Kemp,[3] however, has recorded several other species from brackish-water in the Chilka Lake and has made some interesting observations regarding their habits. So far as *Palaemon carcinus* is concerned, the larvae seem to be liberated in brackish-water, whence they migrate into freshwater and grow into the adult, a phenomenon quite contrary to that observed for Penaeid prawns. The migration of ripe individuals into the backwaters takes place soon after the monsoon, when the salinity is rather low.[4] According to the records of the Travancore State Fisheries Department, this migration for the liberation of the larvae occurs in October and November.[5]

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[1] Henderson, J. R. and Mathai, G., 'On certain species of *Palaemon* from South India', *Rec. Ind. Mus.*, vol. v, pp. 277-305, pls. xv-xvii (1910).

[2] *Ibid.*, pp. 277 and 282.

[3] *Op. cit.*

[4] Reviewing the conditions in the Chilka Lake, Kemp (*op. cit.*) observes:— 'Only females of *Palaemon malcolmsoni* and *P. lamarrei* have been found in the lake and our observations lead us to conclude that these species visit its waters only for breeding purposes. This is also the case with the remaining species of the genus, *P. rudis*, the males of which accompany the females at this period. Adults of these three forms do not live in water as salty as that of the Bay of Bengal; but the young of *P. rudis* were found in the outer channel at the salt-water season, while adults of *P. lamarrei* are able to tolerate a considerable degree of salinity. *P. malcolmsoni* was found only in freshwater.' (*Op. cit.*, p. 264. *Vide* also p. 203.)

[5] *Report of the Agricultural and Fisheries Department, Travancore State*, for 1097 M.E., Trivandrum.

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History of the Industry.

On a rough estimate, it is about sixty years since the industry began in Travancore. Originally, the prawns were collected by ordinary fishing methods which did not involve any large scale fishing, and the operations lingered for the greater part of the year. The open backwaters and not the paddy fields were the fishing areas. As will be seen from the following accounts of the methods of fishing, this condition prevails even now in many parts of Travancore, though the yield from this is negligible as compared with that from the adjoining fields. Modern improved methods of fishing have been in existence only for the past twenty years. The industry first flourished in the backwaters adjoining Parur Taluk. Owing to an increasing demand for prawns and to the high prices which dried prawns began to fetch, the industry rapidly spread to the adjoining taluks of Sherthalay and Vaikam, and to several places in the Cochin State. This became more or less the regular occupation of fishermen inhabiting the banks of the Vembanad Lake, and several industrial establishments sprang up for the collection and preservation of prawns for the market. But hardly had the industry assumed a permanent character, when the price of dried prawns fell and the enthusiasm in this direction waned with the onset of adverse trade conditions. Before discussing this aspect of the question, the methods of capture and the processes involved in geting the prawns ready for the market may be considered.

Fishing Operations.

The season for the fishing operations commences in November, soon after the North-East Monsoon, with the gradual onset of brackish-water conditions in the backwaters. In Travancore, the brackish-water prawn fisheries are best exploited in the Taluks of Parur, Vaikam and Sherthalay. Of these, the produce from the first mentioned place is by far the most important and contributes to about fifty per cent of the total annual produce of the state. In the Cochin state, the important prawn-fishing centres are the villages adjoining the Narakkal canal.

The conditions in the fisheries of the Parur taluk may be taken as more or less typical. Here, the paddy fields closely adjoin the backwaters, and they are on a slightly higher level. As pointed out before, the paddy crop corresponds to a period when the water is fresh. The harvest being over by about the end of September, the fields are free, and for about a month or two the water from the backwaters is allowed to get in and out freely. The flooding caused by the October-November rains often keeps the paddy-fields in direct communication with the backwaters and associated canal systems. The fields contain a lot of organic matter like hay and the November floods bring down plenty of organic as well as inorganic materials. The bottom of the fields remains muddy owing to the loose consistency of the characteristic black soil. The activities of the prawn fisheries begin with the

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lowering of the water-level after the monsoon. The bunds surrounding the fields are strengthened and the communications between the canals and the fields are restricted to a few sluice gates, usually one for each field (Plate II, fig. 1). These gates are carefully guarded by elaborate wooden frameworks, and with the proper manipulation of a series of adjustable planks, the water level in the fields is carefully regulated. The rains having practically ceased, there is no appreciable flow in the canal systems, and the tidal effects are hence markedly felt. The water becomes increasingly brackish. The tidal range is subject to some amount of variation from place to place; it is maximum in places where the shallow waters have been re-claimed into paddy fields which, after reclamation, are cut off from the backwater, leaving only narrow canals amidst them. At Paravoor and Kayenculam, the range is two and a half feet, while in the canals associated with the prawn-fishing centres of Nedungad, Varapuzha, Ezhikara and Chathanad, the tidal range is slightly above the former, and the onset of ebb or flow is attended by a powerful flow of water.

The tidal action is of great advantage to the fisherman. He keeps open the sluice gates during high tide and allows brackish-water to get in freely into the paddy-fields. The prawns, which abound in the backwaters at this period, get into the paddy-fields along with the inflowing water. The gates are closed with the onset of the flow tide. This process is carried on regularly for about a month, whereby the number of young prawns in the paddy-fields is gradually increased. To effect a proper change in the water of the fields, the gates are opened about thrice a week during flow tide and water is allowed to drain off to a certain extent. But to prevent the young prawns from escaping, the gate is guarded by a special contrivance, which consists of a number of flexible twigs of wood joined together to form a lattice-work.

The post-larval stages of *Penaeids* enter the backwaters wherever the latter are in communication with the sea. They are then beautifully transparent and usually measure 1-2 cm. in length. As we know nothing of the breeding habits of marine prawns, it is not possible to ascertain definitely the commencement and duration of the migration of young individuals into the backwaters. Young specimens ranging from 3 to 5 cm. in length are found in the backwaters during many months of the year, especially from August to December. This observation, considered along with the well known fact that most *Penaeids* are not known to breed in brackish-water, would suggest that several batches of young individuals from the sea enter the backwaters. Their rate of growth is astonishingly rapid. Nothing definite is known of the conditions favourable or otherwise to their growth. The prawns entering the fields vary in length from 5 to 8 cm.

The actual fishing of these prawns takes place only after two or three months from the time they have entered into the fields. There is, however, considerable variation from place to place in the period allowed to elapse between the time of entry of the prawns and the commencement of fishing. Size is the main

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1. Bund with sluice gate.

2. Two boats tied together to support the net between them.

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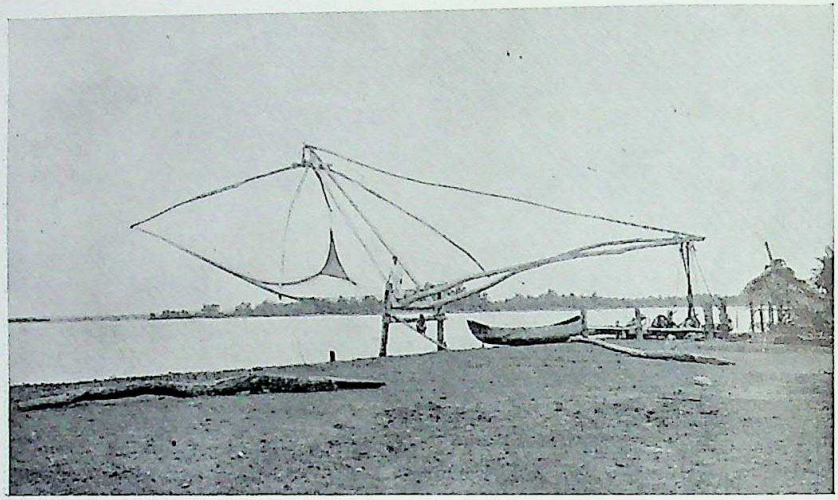
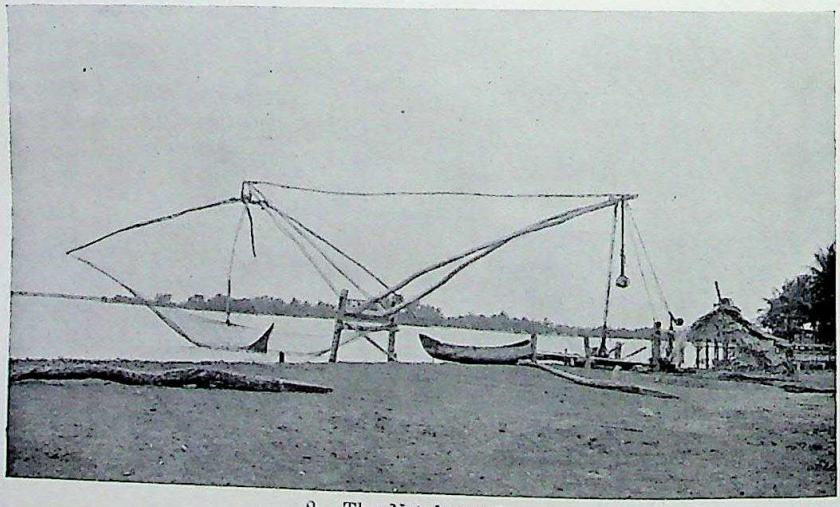
FISHING WITH CHINESE NETS.



1. The Net raised.



2. The Net lowered.

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deciding factor; those usually fished from the paddy-fields are 8-12 cms. long; and the largest ones, obtained after some months since the beginning of fishing operations, are some 13 cms. long, which is about the maximum size to which *Penaeids* grow in brackish-water. With the increase in size of prawns in the fields, the salinity of the water also increases as the rains gradually diminish. This has given rise to a curious belief among the fisher-folk that the prawns really grow by absorbing more and more of salt from the water.

The commencement of the regular course of fishing is an exciting event for the fishermen. The first catch is usually made during the *Thiruvathira* festival which comes off at the end of December or at the beginning of January. A large conical net is fitted to the outside of the sluice gate, the wide portion surrounding the gate. This net is a strong one, with close meshes varying from $\frac{1}{4}$ to $\frac{1}{2}$ inch and very much resembles the *bokshi* of Sindh coasts described by Rai. When the level of water outside the fields begins to fall with the onset of flow tide, the planks retaining the higher level of water in the fields are removed one by one, allowing the water to force its way outside. The numerous prawns that swim out of the fields are caught in the conical nets; they accumulate in the narrow side of the cone. Usually one man waits here and periodically removes the prawns, an easy process as the narrow side of the cone is adjustable.

Fishing is usually done at night and the period corresponds every day to the onset of flow tide; hence the successive periods change according to the phases of the moon. A powerful light is often placed in the sluice gate to lure the prawns to the net.

Fishing in backwaters and canals is also prevalent in addition to that of the paddy fields. Two characteristic methods of open backwater fishing are worthy of note. One is designed to capture prawns swimming in shoals. Two country boats are tied together as shown in the photograph (Plate II, Fig. 2), with the intervening space supporting large nets which trap the prawns that try to swim through. These boats are stationed in key positions frequented by the crustaceans.

The next method is an extremely picturesque one which no one who has visited these backwaters can forget. In almost every edge of the backwaters, a large stellar framework of wood may be seen, supporting large fishing nets locally called the *cheena valai* or *kamba valai*. This peculiar fishing implement is believed to be of Chinese origin, and it is considered as a remnant of ancient trade relations that existed between China and the West coast of India. Fishing with Chinese nets is not mainly intended for prawns; but the latter are caught in large numbers during their season of abundance. The method of fishing with the Chinese nets is an exceedingly simple process and will be clear from the accompanying photographs (Plate III, Figs. 1 and 2). Fishing is usually done only at night, and a lantern is hung to the wooden frame-work when the net is lowered into the water, so as to lure the prawns and fish to the net.

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Curing of Prawns.

Two industrial processes are in vogue for the preparation of prawns for the market: Sun-drying and boiling. The first process is the more common on the Bombay coast, while the latter method followed by drying is the more popular one in Malabar. On the West Coast, boiling is employed in all places where the produce is considerable and sufficient for export to other places. Sun-drying without boiling is employed in the preparation of prawns in those parts of Travancore where the produce is much less than in places like Parur Taluk; they form an article of cottage industry catering only to local demands. In both methods of preparation, the operations should be begun soon after the capture of the prawns, as putrefaction sets in rapidly. Usually, not more than three hours is allowed between the time of capture and the commencement of the first process. Boiling has the advantage of being partially independent of weather conditions. For boiling, the prawns are first put into wide flat copper vessels in a wet state, and often a little extra water is added to prevent them from getting roasted. They are boiled for about half an hour; and when they assume a dark reddish-brown colour, they are removed from the vessels and dried in the sun for several days. It should be noted here that in many places, salt is not generally added when the prawns are cured. The belief among those engaged in the industry is that the salt present in the brackish-water is sufficient for the purpose, and hence, salting is tabooed as being a deceitful measure to increase the weight of dried prawns. Rai observes that the fishermen of the Sindh coasts add a little salt to the fresh prawns when they are boiled. It appears that improper curing is the chief reason why the dried prawns from the West Coast do not remain long in a good condition.

The next process is to get rid of the shells, 'prawn-skins' as they are often called, which include the carapace, rostrum and limbs. For this purpose, large jute sacks are taken and filled with dried prawns to about a fourth of their capacities, after which they are closed and tied up. Women are especially in charge of this part of the work. They swing round each sack and hit it hard on a block of wood until the carapace and limbs fall off, leaving the fleshy parts intact. The latter are removed and sorted out separately; they are popularly called *prawn kernels*.[1] The kernels are once again dried; the pieces of shell adhering to them are carefully removed by hand; and finally, they are packed up in jute bags for export.

The discarded 'skins' are heaped up separately. They are of much use to the agriculturist as they form an important source of manure, especially for coconut palms. Their value as food for poultry has been realized only by a few. Large quantities of 'prawn-skin' used to be exported to Germany and other European countries; but of late, the exports have fallen considerably. The present market rate for prawn-skin varies from Rs. 8 to Rs. 10 per candy.

[1] *Chemmeen-parippu* in Malayalam.

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Marketing of Prawns.

Dried prawns do not command a wide market in India at present. The only place where they are in demand is the Bombay Presidency, where a portion of the local produce caters to the local demands. About half the produce of the Sindh and Bombay coasts is consumed locally, while the rest is exported to different places outside India, mainly to the Far East. The best markets for Indian dried prawns are Rangoon, Singapore, Colombo, Hongkong and Mauritius. As only fresh prawns are popular among people of the West Coast, especially in the important prawn-fishing centres, almost the whole of the produce that is boiled and dried is exported. From statistics available, Rangoon has been the best purchaser for many years. The dealers in Travancore send their supplies to businessmen in Rangoon, who dispose off the material. The price of dried 'prawn-kernels' ranged from Rs. 150 to 300 per candy before the present economic crisis; in some years (1929-30) the figure rose so high as Rs. 350 in the wholesale exporting markets of Cochin and Alleppey. Like all other commodities, the prices have fallen during the past few years; but recently, there has been considerable improvement, the figures having steadily risen from the lowest index of Rs. 50 per candy in 1933 to about Rs. 150 at the time of writing.

Improvement of the Industry.

In discussing the possibilities of improving the prawn industry on the West Coast, we have to examine critically the factors which have been responsible for the present fall in prices. As pointed out before, the general decline in price levels consequent on the current trade slump has considerably affected the commerce of prawns, but the fall in this instance has been mainly due to the numerous handicaps under which the present prawn dealer has to transact his business. First of all, there is no scheme of planned production. Secondly, the method of preparation of prawns for the market is very imperfect. Dried prawns from the West Coast are fit for human consumption only for about four months from the time they are dried and packed. In this respect, the West Coast producer is unable to compete with his Bombay competitors who sell goods of a better quality. The markets where prawns from the West Coast are in demand are rather few at the present time; in these few places, the goods are sold by middlemen. For example, the producers in Cochin and Travancore export their goods to brokers in Rangoon, who sell them to the local dealers under the current market rate, and often take a very high percentage of discount for their services. There have been occasions when about 50 per cent of the net proceeds have been discounted by these agents; and further, prohibitive charges are made for retaining the unsold goods in the godowns. In spite of all these handicaps, the industry has slowly progressed since the capital required is so small as compared to the profit. Whatever the producer gets from prawns is a decent income which compares very favourably with

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what he gets from paddy crops for which his fields are primarily intended.

The increase in the annual produce of prawns from the West coast, depends upon the chances of spreading the industry to other places where prawn-fishing is not extensively carried on and the possibilities of increased output from those areas that are now being exploited. It was pointed out before that in Travancore the best yield is from Parur Taluk. The particular advantage of this place lies in the low level of the paddy fields, the high salinity of the backwaters, and the tidal phenomena. Similar facilities are equally enjoyed by certain other places in Travancore, such as the fields adjoining the backwaters of Kayenculam and the lake of Ashtamudi near Quilon. The species of prawns (both the brackish-water as well as the migratory forms) collected from Parur are obtained at those places also. But here, the methods of paddy cultivation are not quite suited to the conversion of these fields into 'prawn-yards'. As an experimental measure, it would be desirable to attempt finding out if the methods of cultivation followed at Parur may be copied here, with a view to introducing an intervening prawn season. It should be mentioned, however, that in such a change the factors involved are many. Every possible means of effecting suitable changes in periods of cultivation should be explored so as to ensure a regular output of prawns in addition to paddy. If successful, this would be of considerable advantage to the owners of paddy fields, as the income from paddy has been steadily on the decline for the past so many years, and any supplementary income would be of much benefit to them.

For increasing the output of prawns from those localities where the industry already exists, we must know much more about the feeding, breeding, and migratory habits of the prawns in question, about which so little is known at the present day. It should also be found out if the continuance of the paddy crop in the fields is of advantage or of disadvantage to the industry. It is reasonable to expect better produce in certain fields near the sea if they are converted into permanent prawn-yards more or less on the lines of the prawn-fisheries of the Sindh coasts.

Improvements in methods of preservation, whereby the dried prawn kernels could be kept properly for longer periods, would be highly useful as it would enable export to far off places. A constant supply throughout the year could also be ensured in this way. There may also be an increased demand for dried prawns from inland towns of India. But in popularising prawns in Indian markets, methods which will enable their being sold fresh are likely to meet with better results than those intended for the distribution of dried material. Small quantities of fresh prawns are at present sent from important prawn fishing centres on the West Coast to Madras, Trichinopoly and other places. They are packed along with ice, in large deal-wood boxes, and sent by the Railway; and in the markets of the above mentioned places, iced-prawns are soon sold out. In the present state of the industry, it is doubtful if large-scale brine-freezing and allied

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methods for the distribution of fresh prawns would meet with immediate success in India; but this may become beneficial with increased output and with increased demand for fresh material. With proper organization, the producers could have their own establishments in the best selling centres and the loss through the middlemen could thus be eliminated. The Government trade agencies could do much to popularise the product. It would thus be seen that for the improvement of the industry, there must be planned production, improved marketing facilities and co-operative enterprise amongst those engaged in the industry. Biological research has much to contribute towards the success of the industry by providing accurate and detailed information on the bionomics and life-histories of prawns of economic importance, which will eventually help in the proper exploitation of the available fishery resources. Much important statistical data are also badly needed. In course of time, protective legislation may be necessary to prevent over-fishing and wastage which are detrimental to any fishing industry. With all these factors attended to, it is not unreasonable to anticipate the development of a very important and lucrative industry from organized prawn culture and prawn fishing in the West Coast.

Explanation of Plates.

Plate I.

Fig. 1.—An ovigerous female of *Palaemon sp.* (about natural size). l_2, the second thoracic leg which grows to an enormous size in the male; *ov*, developing eggs.

Plate II.

Fig. 1.—The sluice gate between the paddy-field and the adjoining canal. The fisherman on the boat is holding the conical net tied to the gate. Photograph taken from a locality near Parur (North Travancore).

Fig. 2.—Open fishing in the backwater, with two boats fastened together, intended to catch prawns swimming in shoals. Photograph from the same locality as the above.

Plate III.

Figs. 1 and 2.—Two views of the characteristic Chinese nets in the backwaters of Travancore and Cochin. In fig. 1 the net is in the raised position, while in the second it is partly lowered.

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NOTES ON MURREE BIRDS.

BY

REV. E. A. STORRS FOX.

The following notes are chiefly by way of a commentary on previous notes by Lt.-Col. R. H. Rattray which appeared in vol. xvi of the *Journal*, and those by Major H. A. F. Magrath which were published in vol. xix. These present notes do not however include the birds of the Galis, unless specially mentioned, but only those found on the Murree hill itself. I was stationed myself in Murree during the years 1932 to 1935 including one complete winter and parts of two other winters, and have therefore had opportunities, such as do not appear to have been enjoyed by the two former writers, of observing the Murree bird life at all seasons of the year.

The following observations are intended to supplement those already made by the two writers above-mentioned.

Dendrocitta rufa. The Indian Tree Pie. This bird is not mentioned either by Col. Rattray or Major Magrath. I have never seen one as high as Murree itself, but have noticed it several times near Company Bagh (4,500 ft.) on the road down to Tret.

Garrulus lanceolatus. The Black-throated Jay. Very much in evidence all over the station during the winter (and rather less so in summer), but I have never seen it going about in flocks as e.g. at Mussoorie.

Machlolophus xanthogenys. The Yellow-cheeked Tit. I should not call this a rare bird, as Col. Rattray does, but it is certainly not as common as the other four Murree tits. Nor is it really shy and I have often seen it on the Mall and in my own compound within a few feet of the house.

Lophophanes melanolophus. The Crested Black Tit. The commonest of the Murree tits in winter but much less often seen in summer.

Lioptila capistrata. The Black-headed Sibia. Common in winter but less so in summer.

Pteruthius erythropterus. The Red-winged Shrike Tit. Fairly common in winter, but I have not seen it during the summer months.

Cephalopyrus flammiceps. The Fire-cap. I have only seen this bird at Murree in April, so conclude it was then on the way up to higher levels, as Col. Rattray mentions it as being quite common on the high hills near the Galis.

Molpastes intermedius. The Punjab Red-vented Bulbul. I saw a few of these birds on a number of occasions in January 1933 when the snow was lying thick. What made them come up to Murree at this particular time of year I cannot think. I have never seen them at any other season.

Molpastes leucogenys. The White-cheeked Bulbul. I have never seen these birds on the Murree hill in summer higher than about 5,500 ft. By the end of November they begin to come into Murree, and after the snow has fallen they become very abundant (attracted I suppose by the very plentiful supply of berries). As the spring advances they retire downhill again. Major Magrath says that he saw a pair in Murree on April 29th, but this is rather late for them.

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Sitta kashmirensis. Brook's Nuthatch. Neither Col. Rattray nor Major Magrath mention this bird. It is rare in Murree, but I have occasionally seen one during the summer.

Sitta leucopsis. The White-cheeked Nuthatch. Like Major Magrath, and unlike Col. Rattray, I have not found this bird uncommon at times. I am not sure however that it breeds in Murree and am rather inclined to think that it does not. About the middle of October it becomes rather plentiful for a few weeks and after that scarce again, which leads me to suppose that Murree is only being made a temporary halting place. I have however seen specimens in mid-winter and as late as June 26th, but none after that date until the following October.

Dicrurus ater. The Black Drongo. This bird seems common in summer, though perhaps not as common as the Ashy Drongo.

Anorthura neglecta. The Kashmir Wren. Common in winter; November 11th is the earliest date I have seen it and none later than March 15th.

Regulus cristatus. The Goldcrest. Fairly common between the beginning of December and the middle of February, but I have not noticed it during the summer.

Cryptolopha xanthoschista. Hodgson's Grey-headed Flycatcher-warbler. Like Col. Rattray, I have not found this bird common. Major Magrath notes it as being very common in April. I have certainly seen it most often about then; I have also noticed it at the end of December.

Campophaga melanoschista. The Dark Grey Cuckoo-shrike. Comparatively plentiful in the summer of 1935, but I only saw one in 1933 and none in 1934.

Oriolus kundoo. The Indian Oriole. Very common in summer. First makes itself evident towards the end of April.

Aethiopsar fuscus. The Jungle Myna. Col. Rattray seems to have found it common. My own experience has been the opposite, as I only saw two pairs nesting in 1933 and one pair in 1934, though a few more in 1935.

Hemichelidon sibirica. The Sooty Flycatcher. Colonel Rattray notes these as very rare; Major Magrath found them common till the middle of May. Personally I remember none during 1933 and 1934, but saw quite a number between the end of April and the beginning of August during 1935.

Terpsiphone paradisi. The Indian Paradise Flycatcher. Major Magrath mentions a single specimen. I have never seen one in Murree, but have heard of them being seen below Sunny Bank and near the Brewery.

Rhipidura albifrontata. The White-browed Fantail Flycatcher. I have seen this bird in summer above the Brewery and below the Lawrence College, but I believe it to be rare.

Pratincola maura. The Indian Bush-Chat. Quite common after the middle of March up to 7,000 ft.

Oreicola ferrea. The Dark-grey Bush-Chat. Abundant in summer. Begins to arrive about the middle of March.

Enicurus maculatus. The Western Spotted Forktail. Not common on the Murree hill; I only saw two or three pairs in 1933 and 1935, and only one pair I think in 1934.

Chaimarrornis leucocephalus. The White-capped Redstart. I have never seen this bird in Murree itself, but I noticed one at Company Bagh (4,500 ft.) in January 1933, and another at Chrrapani (4,000 ft.) in January 1935.

Ruticilla frontalis. The Blue-fronted Redstart. Fairly common in winter; not seen before November 21st or later than April 30th.

Ruticil'a erythronota Eversmann's Redstart. Fairly common during winter; first seen on November 28th.

Ianthia rufilata. The Red-flanked Bush Robin. Fairly common from October to April.

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Adelura cæruleicephala. The Blue-headed Robin. Begins to arrive about the end of October (first seen on October 26th), and is extremely abundant throughout the winter. Last seen on March 22nd.

Merula castanea. The Grey-headed Ouzel. I have not noticed this bird in Murree during the summer, but it is fairly common in winter from the beginning of November.

Merula atrigularis. The Black-throated Ouzel. Begins to arrive in Murree in considerable numbers in November (first seen on November 21st), and thereafter becomes very abundant, especially after the snow has begun to lie, during which period no bird in Murree is in greater evidence. With the arrival of spring the bird departs, but I have seen a few at any rate as late as April 24th. Possibly some remain into the summer.

Pyrrhula aurantiaca. The Orange Bullfinch. Not very common, but occasionally seen during mid-winter, and as late as March 16th in 1935.

Propasser grandis. The Red-mantled Rose Finch. Common from the middle of November till the end of March.

Carduelis caniceps. The Himalayan Gold Finch. Not very common, but seen sometimes in January when the snow is lying deep.

Callacanthis burtoni. The Red-browed Finch. I once saw a pair in January 1933, but none since.

Metoponia pusilla. The Gold-fronted Finch. This bird is seen occasionally in small flocks in mid-winter.

Hypacanthis spinoides. The Himalayan Greenfinch. Common from the latter part of the summer onwards. The ripening of the sunflower-seeds always seems to be the signal for a great invasion by flocks of these birds.

Emberiza stewarti. The White-capped Bunting. I have not found this bird as common as Col. Rattray seems to indicate, but I have seen it in Murree from April onwards.

Chelidon urbica. The Martin. Col. Rattray speaks of the Kashmir Martin not being found in Murree, while Major Magrath mentions this same bird (*Chelidon kashmiriensis*) breeding in considerable numbers in the verandahs of bungalows near the water tanks; he also thinks that the European House Martin occurs in some of these colonies. Nowadays there is a large colony of Martins breeding every year at S. Denys' School (near the water tanks), and I have had plenty of opportunities of studying them closely. Although I have not actually killed a specimen, I have watched them so often through my glasses on their nests only a few yards away as to be convinced that all these birds are urbica and not kashmiriensis.

Motacilla personata. The Masked Wagtail. One or two specimens seen in March.

Motacilla hodgsoni. Hodgson's Pied Wagtail. A pair once seen in September near Lower Topa.

Motacilla melanope. The Grey Wagtail. I have seen a number passing through in April and early May, and again at the end of August. One pair (presumably the same each trip) always halts in my garden for a week or so both on the upward and downward journey.

Anthus trivialis. The Tree Pipit. I have seen a few specimens late in April and early in May, and once a pair at Patriata in the first week in April.

Gecinus occipitalis. The Black-naped Green Woodpecker. Colonel Rattray seems to have found this bird fairly common. I never came across any till October 1935 when I saw two pairs.

Hypopicus hyperythrus. The Rufous-bellied Pied Woodpecker. Rare; I only saw two during the summer of 1933 and one in summer of 1934; commoner in 1935.

Dendrocopus auriceps. The Brown-fronted Pied Woodpecker. Much more common in winter than in summer, but never so abundant as Gecinus squamatus or Dendrocopus himalayensis (the two commonest Woodpeckers in Murree).

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Picumnus innominatus. The Speckled Piculet. I have once seen this bird in November 1934.

Cyanops asiatica. The Blue-throated Barbet. Common in summer after the beginning of May, though never as common as the Great Himalayan Barbet (which is abundant all the year round). I once saw this bird on January 2nd sitting on a tree in the snow by the side of the Mall, but this is the only specimen I have seen during the winter months.

Upupa epops. The European Hoopoe. Common after the middle of March.

Cypselus melba. The Alpine Swift. I have only thrice been able to identify this bird for certain when I saw a large number on November 7th, 1934, hawking above the old Terrace Hotel, and again in July and August 1935.

Cuculus canorus. The Cuckoo. First heard on April 15th; very common thereafter, and also very tame.

Cuculus saturatus. The Himalayan Cuckoo. First heard on April 20th. Not quite so common as canorus, and rather more bashful as a rule.

Palæornis schisticeps. The Slaty-headed Paroquet. Common in summer, though not I think as plentiful as in some hill stations. I have rarely seen it in winter, but once remember noticing a large and very dejected looking flock sitting on a bare tree near the Mall in a snowstorm during January.

Glaucidium cuculoides. The Large Barred Owlet. I have seen this bird but do not think it is common.

Glaucidium brodiei. The Collared Pigmy Owlet. From my own observations this bird seems much commoner than the last-named.

Gypaëtus barbatus. The Lammergeyer. Neither Col. Rattray nor Major Magrath mention this bird, but it is very common in Murree.

Buteo ferox. The Long-legged Buzzard. I have seen a good number of (what I take to be) these birds.

Astur palumbarius. The Goshawk. I have seen this bird once or twice in winter.

Sphenocercus sphenurus. The Kokla Green Pigeon. I have seen it in Murree, but should not have thought it common there now.

Palumbus casiotis. The Eastern Wood-Pigeon. Seen in winter in flocks.

Turtur ferrago. The Indian Turtle-Dove. Col. Rattray found it common in summer, while Major Magrath apparently only noticed it migrating at the end of April. My own experience agrees with the former.

Gennæus albicristatus. The White-crested Kalij Pheasant. Col. Rattray did not think this bird common in 1905. I have only seen (and eaten) it dead in Murree, and believe that it has probably been more or less exterminated by now in the immediate vicinity of the station.

Caccabis chucar. The Chukor. I have not seen this bird wild in Murree, and think that its numbers too have probably been reduced to a negligible quantity since Col. Rattray wrote.

Hydrophasianus chirurgus. The Pheasant-tailed Jacana. I saw one of these birds on the water tanks on May 31st 1933, and understood that they sometimes migrate by way of the Jhelum valley; but it cannot be often that a specimen finds itself on the top of the Murree hill.

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ON TWO NEW SPECIES OF *ANTHOCEROS* LINN. 1753 FROM SOUTHERN SHAN STATES, BURMA, WITH A COMPARATIVE CHART OF THE DIOECIOUS DARK SPORED SPECIES OF THE GENUS.

BY

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(*Biological Department, University of Rangoon*).

The material for this paper was obtained from the Southern Shan States, Burma.

Anthoceros meggitti sp.n.[1] (Pl. I, Figs. 1-5).

Locality.—Kalaw.

Dioecious. Thallus 12-15 × 3-8, slightly depressed in the centre, the margin lobed. Surface cells 0.04-0.06 × 0.03-0.04, each with a large chloroplast; cavernous. Involucre 6-7 long × 0.5 broad, cylindrical, slightly narrowed at the nearly truncate apex. Capsule 46-55 long × 0.5 broad, dark brown; stomata 0.075-0.09 × 0.042-0.05. Spores 0.04-0.045 black, thickly granular-papillate; pseudoelators 1-5 celled, dark brown, thin walled. Male plants smaller than the female. Antheridia 0.17 × 0.105, in groups of many in receptacles with a denticulate margin, scattered over the dorsal surface of the thallus.

A. curnowii Stephani 1916, *A. koshyii* Khanna 1936, *A. minutus* Mitten. *A. miyakeanus* Schiffner 1899, are separated from the present form by the solid structure of their thallus and their shorter involucres; *A. chabensis* Kashyap 1917, *A. cucullatus* Stephani 1916, *A. faurianus* Stephani 1916, *A. lamellatus* Stephani 1916, *A. myriandroecius* Stephani 1916, *A. parkinsonii* Khanna 1933, *A. pichinchesis* Stephani and *A. telaganus* Stephani 1916, differ from the present form in having smaller involucres and in the size of their capsules; *A. chevalieri* Stephani 1923 and *A. erectus* Kashyap 1915 are distinguished from the present type by their longer capsules; *A. weistii* Khanna 1932 differs from the present form in the size of the plant and stouter involucre; *A. ferdianus* Stephani 1916 differs from the present form in having bigger capsule and bigger spores. It is therefore necessary to create a new species for which I propose the name *Anthoceros meggitti* sp.n.

Anthoceros burmani sp.n. (Pl. II, Figs. 6-10).

Locality.—Taunggyi.

Dioecious. Thallus 12-17 × 7-8, prostrate, with irregularly divided segments; segments linear or oblong, channelled, with the margins ascending and sinuate. Surface cells 0.050-0.065 × 0.02-0.04; cavernous. Involucre 6-8 long × 1.3-1.5 broad, cylindrical, narrowed towards the apex, the mouth lobulate. Capsule 12-15 long × 0.3 broad; stomata 0.06 × 0.04. Spores 0.058, black with numerous spines; pseudoelators thick walled, dark brown, 1-4 celled. Male plants much smaller than the female. Antheridia in groups of 12 or less scattered over the dorsal surface of the thallus.

The longer involucre and the shorter capsule separates the present form from *A. chambensis* Kashyap 1917, *A. chevalieri* Stephani 1923, *A. cucullatus* Stephani 1916, *A. erectus* Kashyap 1915, *A. faurianus* Stephani 1916, *A. lamellatus* Stephani 1916, *A. myriandroecius* Stephani 1916, *A. pichinchesis* Stephani and *A. telaganus* Stephani 1916; the cavernous structure of the thallus from *A. curnowii* Stephani 1916, *A. koshyii* Khanna 1936, *A. minutus* Mitten and

[1] All measurements are in millimetres.

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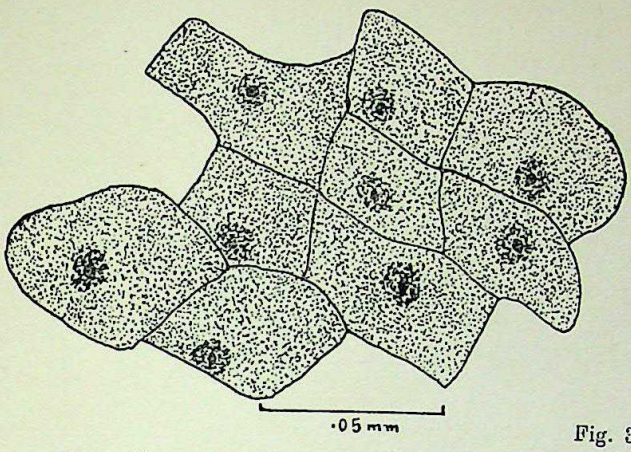

Fig. 3.

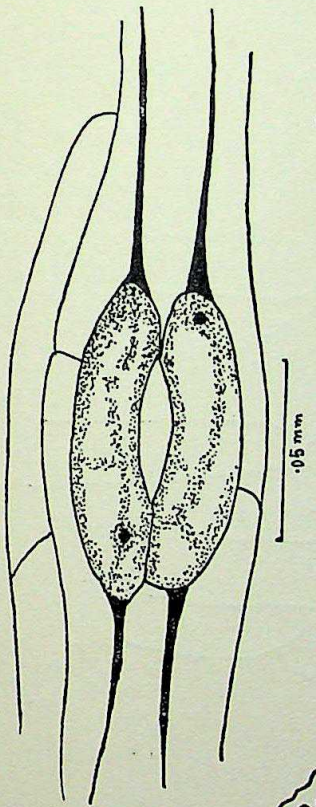

Fig. 4.

Fig. 5.

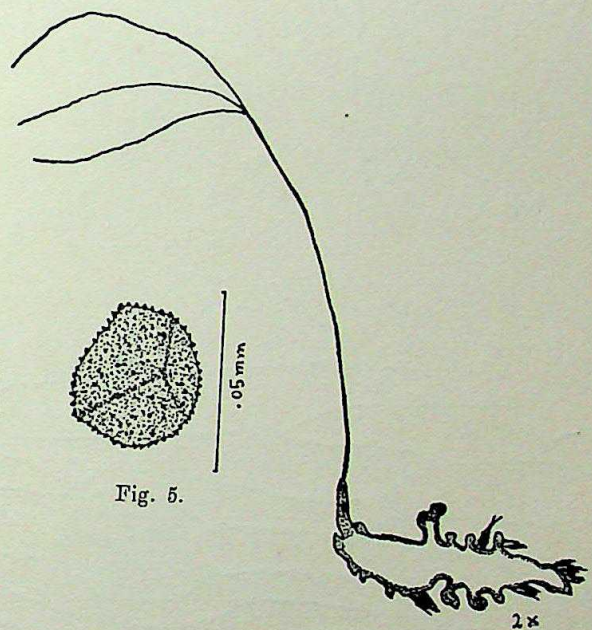

Fig. 1.

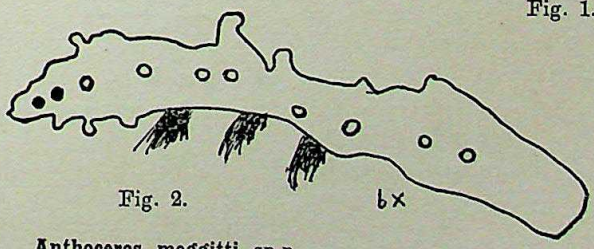

Fig. 2.

Anthoceros meggitti sp.n.

For explanation see end of text.

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Fig. 10.

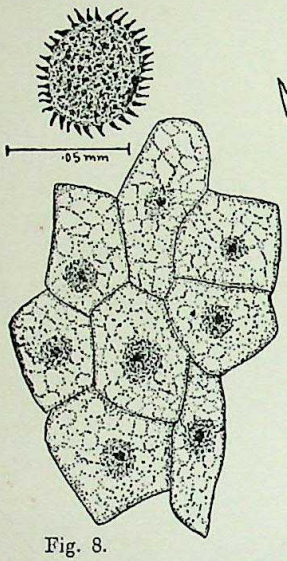

Fig. 8.

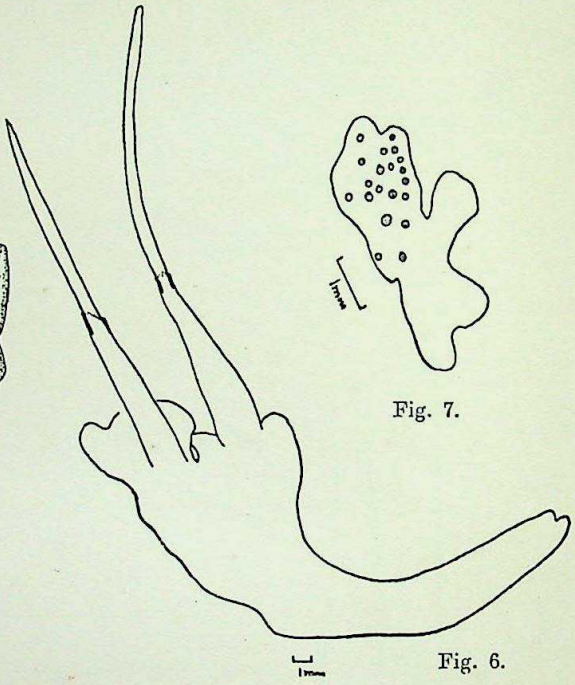

Fig. 6.

Fig. 7.

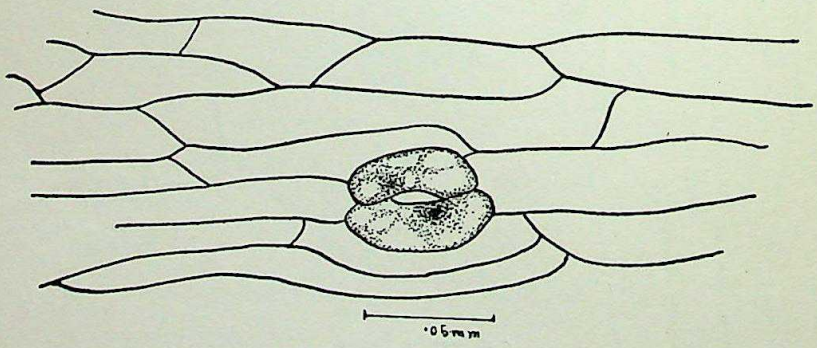

Fig. 9.

Anthoceros burmani sp.n.

For explanation see end of text.

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Anthoceros Linn. 1753 (Diœcious and dark spored species)

	Thallus	Size	Involucre	Capsule	Spores	Distribution
burmani Khanna sp. n' ...	cav.	12–17 × 7–8	6–8 × 1·3–1·5	12–15 × 0·3	·058 sp.	Burma : Kalaw.
chambensis Kashyap 1917...	cav.	...	2·5	25	·04–·048	India : Chamba Valley, Punjab, Sialkot.
chevalieri Stephani 1923 ...	cav.	20	...	20	·045 pap.	Africa centralis.
cucullatus Stephani 1916 ...	cav.	15	2	50	·036 asp.	Guadeloupe.
curnowii Stephani 1916 ...	solid]	15	...	...	...	Britain : Cornwall.
erectus Kashyap 1915 ...	cav.	10	...	30	·03–·04	India : Outer and Kumaon Himalayas, Madras ; Travancore.
faurianus Stephani 1916 ...	cav.	10	3	30	·036 hisp.	Japan.
ferdinandi Taylor ...	cav.	10	6	60	·045 echin.]	Australia : Port Denison.
koshyii Khanna ...	solid]	5–12	2·8–3·6 × ·8	12–15 × 1·0–1·5	.046–·065 pap.]	India : Trivandrum.
lamellatus Stephani 1916 ...	cav.	5	4	20	·045 hisp.	Brasilia : Rio de Janeiro.
meggitti Khanna sp. n. ...	cav.	12–17 × 7–8	6–7 × ·9	46–55 × ·5	·04 gr. pap.]	Burma : Taunggyi.
minutus Mitten ...	solid]	20	...	...	...	Africa.
miyakeanus Schiffner 1899...	solid]	15 × 5	1	10	...	Japan.
myriandroecius Stephani 1916 ...	cav.	12	2	30	·054 pap.	Africa.
parkinsonii Khanna 1933 ...	cav.	5–14	1·65–2·8	13·0–30·0 × ·28–·45	·041–·052	Burma : Maymyo.
pichinchesis Stephani ...	cav.	...	3	30	·05 asp.	Andes, in Monte Pichincha
telaganus Stephani 1916 ...	cav.	5	5	20	·045 pap.	Java.
weistii Khanna 1932 ...	cav.	30–50	6–10 × 1·5–2·5	30–66	·038–0·53	Burma : Rangoon.

asp. = asperulous
cav. = cavernous.
echin. = echinulate.
gr. pap. = granular papillate.
hisp. = hispid.
pap. = papillate.
sp. = spinous.

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A. miyakeanus Schiffner 1899; shorter capsule and bigger spores from *A. ferdinandi* Taylor, *A. meggitti* sp.n. and *A. weistii* Khanna 1932; longer involucre and bigger spores from *A. parkinsonii* Khanna 1933. It is, therefore, necessary to create a new species for which I propose the name *Anthoceros burmani* sp.n.

In the table above the differences between the present forms and the previously described dioecious dark spored species are tabulated.

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Reference for the Text-Figures.

Anthoceros meggitti sp.n.: Fig. 1.—Female plant; Fig. 2.—male plant; Fig. 3.—dorsal epidermal cells; Fig. 4.—stoma, Fig. 5.—spore; *Anthoceros burmani* sp.n.: Fig. 6.—female plant; Fig. 7.—male plant; Fig. 8.—dorsal epidermal cells; Fig. 9.—stoma; Fig. 10.—spore.

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THE MEDICINAL SPIDERWORTS OF INDIA.

BY

J. F. CAIUS, S.J., F.L.S.

The COMMELINACEAE are perennial herbs generally distributed in the Tropics and Subtropics, a few in China and Japan, the Southern United States and in Australia. The family includes 30 genera with about 400 species.

Many species possess an abundant mucilage, which is alimentary after being cooked; and the tuberous rhizomes of some contain, besides mucilage, starch, which adds to their nutritive qualities. The species credited with medicinal properties belong to 8 genera:—ANEILEMA (Tropics); COMMELINA (Tropics and Subtropics); CYANOTIS (Tropical Asia and Africa); FLOSCOPA (Tropics); PALISOTA (Tropical Africa); POLLIA (Old World Tropics and Subtropics); TINANTIA (Mexico to Brazil); TRADESCANTIA (Tropical and North America).

The medicinal Spiderworts of India belong to 4 genera:—ANEILEMA, COMMELINA, CYANOTIS, FLOSCOPA.

I. Capsule loculicidal. Stamens 3, perfect; with 1-3 staminodes.
  1. Cymes solitary, included in a spathe. Ovary 3-celled; cells, 1-2 ovuled ... ... COMMELINA.
  2. Cymes naked, panicled, rarely in a spathe ... ANEILEMA.

II. Capsule loculicidal. Stamens 6, perfect.
  1. Cymes from imbricating bracts, scorpioid, or 1-2-few-flowered. Corolla tubular below ... ... CYANOTIS.
  2. Flowers panicled. Stem erect ... ... FLOSCOPA.

ANEILEMA.

This genus numbers 85 species, tropical and subtropical, chiefly Asiatic.

In the Gold Coast Colony the leaves of *A. beninense* Kunth. and *A. ovato oblongum* P. Beauv. are used in enemas to cure constipation.

Four Indian species are used medicinally either in India or in Malaya.

I. Cells of ovary 3-8-ovuled; cells of capsule 1-3- or more-celled.
  1. Stout plant with large leaves; seeds 3 or 4 in a cell, smooth ... ... 2. *A. lineolatum.*
  2. Tufted herb; seeds 5 or 6 in a cell, superposed, sharply 3-gonous ... ... 4. *A. scapiflorum.*

II. Cells of ovary 2-ovuled; cells of capsule 2-seeded. Small herb, decumbent ... ... 3. *A. nudiflorum.*

III. Cells of ovary 1-ovuled; cells of capsule 1-seeded. Stout herb ... ... 1. *A. conspicuum.*

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1. **Aneilema conspicuum** Kunth. is found in the Patkai Hills of Assam, whence it extends to Burma and Siam, Penang, Malacca, Sumatra and Java.

The plant is used medicinally by the Malays, and is said to be a powerful emmenagogue.

Malay: Poko tampoh kalin—.

2. **Aneilema lineolatum** Kunth. occurs throughout Tropical India; in the Western Ghats from the Konkan to Travancore; and from Sikkim, Bhotan and the Khasia Hills up to 2-4,000 ft., to Burma, Malaya and the Malay Islands.

The plant is used by the Malays as an abortifacient.

Malay: Poko mati hidup—.

3. **Aneilema nudiflorum** Br. is to be found throughout India; from the North-West Himalaya ascending to 6,000 ft. eastwards and southwards to the Khasia Hills, Burma, the Deccan, Travancore and Ceylon. It is a common weed in waste ground and dry sandy places throughout the Malay Peninsula. It is also met with in China.

The herbage cooked in oil is employed in the treatment of leprosy and ringworm.

Malay: Rumput kurumit, Rumput lipah lumbu, Rumput sarang tupai, Rumput tapah burong—.

4. **Aneilema scapiflorum** Wight is a native of the Himalaya. It is spread from the Upper Gangetic plain to Bhotan, Travancore, Tenasserim, Ceylon and the Shan Hills.

The root is said to have astringent and tonic properties. It is considered useful in headache, giddiness, fever, jaundice and deafness. It is also regarded as an antidote to poisons, and as a cure for snake-bite.

The root-bark dried in the shade is said to have been employed with benefit in asthma. It is commonly used in colic, piles and infantile convulsions. It is a remedy of great repute for impotence and spermatorrhoea and also for incontinence of urine.

The dried powder is much used in combination. Mixed with sugar it is employed as an aphrodisiac. With the juice of the *tulsi* leaves it is given for pains in the kidneys, and is one of the chief remedies used by the Hakims in spermatorrhoea. With long pepper it is prescribed in bites of mad dogs, both internally and externally.

Mhaskar and Caius have shown experimentally that the drug is not an antidote to snake venom.

Bengal: Kureli—; *Gujerati*: Sismulia—; *Hindi*: Siyahmusli—; *Persian*: Musli-e-riyah—.

Commelina.

This genus includes 115 tropical and subtropical species.

Many species are used medicinally in various parts of the world:—*C. communis* Linn. in China; *C. pallida* Willd. and

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C. tuberosa Linn. in Mexico; *C. deficiens* Herbert in Brazil; *C. barbata* Lam. and *C. benghalensis* Linn. in La Reunion; *C. madagascarica* C. B. Clarke in Madagascar; *C. africana* Linn. and *C. benghalensis* Linn. in South Africa; *C. nudiflora* in the Gold Coast.

The species used therapeutically in India number five.

I. Capsule 3-celled; two cells with 2, and one with 1 seed.
1. Leaves elliptic to ovate-lanceolate, 2 to 3 in. long, glabrous; seeds cylindric reticulate, black ... 2. *C. nudiflora.*
2. Leaves linear-lanceolate, 3 to 6 in. long, nearly glabrous; seeds globose, smooth, truncate, black powdered with white ... ... 4. *C. salicifolia.*
3. Leaves elliptic or ovate, blunt, 1 to 3 in. long, pubescent; seeds closely pitted ... ... 1. *C. benghalensis.*

II. Capsule 3-celled, subequally 3-valved.
Leaves lanceolate oblique acuminate, many-nerved, 6 in. long; seeds ellipsoid compressed, lead-coloured, margins often marbled ... ... 3. *C. obliqua.*

III. Capsule 2-celled.
Leaves ovate-lanceolate acuminate, 3 in. long, scabrid pubescent; seeds ellipsoid rugose, straw-coloured or brown ... ... 5. *C. suffruticosa.*

1. **Commelina benghalensis** Linn. occurs in the peninsula of India generally, and is fairly common everywhere. It is also found in Ceylon, Burma, the Malay Peninsula, China and Tropical Africa.

The plant is described by Ayurveda as bitter, useful in leprosy, and a good regulator of the nervous system.

In La Reunion the plant is reputed emollient and mucilaginous. It is much used in the form of a decoction as a drink, a lotion or a bath.

The Sutos prepare from it a medicine for treating barrenness in women.

Bengal: Kachradam, Kanchara, Kanchura, Kanshira, Kanuraka—; *Canarese*: Hittagani—; *English*: Day Flower, Dew Flower—; *Gujerati*: Mhotunshishmuliyun—; *Hindi*: Kanchara, Kanuraka—; *La Reunion*: Grosse herbe d'eau, Grosse trainasse—; *Malay*: Rumput mayiam—; *Marathi*: Kena—; *Pampangan*: Biasbias—; *Philippines*: Alibangon, Anagalide azul, Uligbonggon—; *Punjab*: Chura, Kanna, Khanna—; *Sanskrit*: Kanchata: Marishajalaja, Paniya, Tanduliya—; *Santal*: Kana arak—; *Sind*: Chura, Kanna, Khanna—; *Sinhalese*: Deyamainaireya, Diyameneriya—; *Spanish*: Anagalide azul—; *Suto*: Khotswana—; *Tagalog*: Alicbanggon—; *Tamil*: Kanangakarai—; *Telugu*: Nirukassuvu, Vennadeviruka—; *Twi*: Onyame bewu na mahu—; *Visayan*: Cabilao, Sabilao, Sabilaonggalabaan—.

2. **Commelina nudiflora** Linn. is very common in waste land everywhere. It is frequent in Bengal and extends to Burma, the Malay Peninsula and Ceylon. It is distributed to most of the tropical and subtropical countries: Africa, Madagascar, the Seychelles, Mauritius, the Sandwich Islands, Australia, etc.

The leaves are used by the Malays for poulticing sores.

The natives of the Gold Coast Colony use the plant to cure a disease called 'okwaha'—a swelling in the groin—producing very itchy spots and sores and swellings. The leaves are pounded,

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mixed with the seeds of *Leea guineensis* G. Don. and those of long pepper. The mixture is then put in a plantain leaf, which has first been warmed to prevent it from splitting too easily, applied to the affected parts, bound, and kept there for three days. The application first affords relief; and when it is removed on the fourth day it is found that the swelling bursts.

Ashanti: Onyame bewu na mawu—; *Awuna*: Agbenokui nokui, Agbormaku maku—; *English*: Day Flower, Dew Flower—; *Ewe*: Agbenkui nokui, Agbormaku maku—; *Fanti*: Nyame bewu ansang na mewu—; *Ga*: To lilairy—; *Gujerati*: Shishmuli, Shishmuliyun—; *Hausa*: Balasa, Balasaya, Kunungura—; *Hindi*: Kanshura—; *Malay*: Pulau aur, Rumput kukupu, Tapak eti—; *Marathi*: Kina, Velichibhaji—; *Nzima*: Nyamele wua ngwosu—; *Philippines*: Aligbangon—; *Sanskrit*: Katsapriya, Koshapushpi—; *Spanish*: Anagalide azul—; *Twi*: Onyame bewu na mawu—.

3. **Commelina obliqua** Ham. is common over the low moist parts of India, flowering during the rainy season chiefly. It also occurs on the lower Himalaya, ascending up to 7,000 ft. in altitude. It is distributed to Ceylon and Burma, and hence to the Malay Peninsula where it is mostly found in the shady spots of the forests.

The root is a refrigerant and laxative, useful in strangury and costiveness. It is used in vertigo, fevers and bilious affections, and as an antidote to snake-bites.

Mhaskar and Caius have demonstrated that the root is not an antidote to snake venom.

Bengal: Jatakanchura, Jatakanshira—; *Bijnor*: Kana, Korna—; *Hindi*: Kana, Kanjuna—; *Kumaon*: Kanjura—.

4. **Commelina salicifolia** Roxb. is common in wet places in the peninsula of India, especially in Bengal, Coromandel and Bombay. It is distributed to Burma and to the Malay Peninsula where it is met with in abandoned rice-fields. It also occurs in Java.

The plant is used in dysentery and insanity.

Bengal: Languli, Panikanchira—; *Hasada*: Madtonggaara, Madtonggatasad—; *Hindi*: Jalpipari—; *Sanskrit*: Jalapippali, Languli, Langulu—; *Santali*: Bir kana arak'—.

5. **Commelina suffruticosa** Bl. is a native of Bengal. It is found in Tropical India from Nepal, Sikkim and Bengal to Central India and the Malay Peninsula. It is distributed to the Malay Islands.

The Santals apply the root to sores.

Santali: Dare orsa—.

Cyanotis.

This genus consists of 35 palaeotropical species, two of which are used medicinally in India.

1. Cymes enclosed in biseriate falcate imbricating bracteoles ... ... 2. *C. tuberosa.*
2. Cymes from the leaf sheaths axillary ... ... 1. *C. axillaris.*

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1. **Cyanotis axillaris** Schult. f. is a herbaceous annual, met with in many parts of India, in the plains from the Upper Gangetic valley to Assam and southwards to Ceylon. It may be found in rice-fields in some parts of Malaya. It is distributed to Siam, China and Australia.

The Indians occasionally drink a decoction of the plant for dropsy.

On the Malabar Coast it is considered as a useful remedy in tympanitis.

In Behar it is used as an external application in cases of ascites, especially when mixed with a little oil.

Bombay: Itsaka—; *Hindi*: Baghanulla, Soltraj—; *Jolo*: Hauli—; *Tamil*: Nirpulli—; *Telugu*: Golagandi—.

2. **Cyanotis tuberosa** Schult. f. is found in Chota Nagpore, the Deccan Peninsula—on the west side from the Konkan to Travancore—and in Ceylon.

The root is given in long-continued fevers, and also for worms in cattle.

Santali: Hodojerengarak , Meromchunchi—.

Floscopa.

The genus consists of 15 tropical and subtropical species.

Floscopa scandens Lour. occurs throughout tropical India, in swamps from Eastern Nepal, Sikkim and the Khasia Hills to Travancore, Ceylon and Malacca, where it is common in muddy ditches. It is distributed to Eastern Asia and tropical Australia.

In Lakhimpur (Assam) the juice of the stem is put into sore eyes.

Lakhimpur: Karahimlu—; *Malay*: Rumput kumpai tikus, Rumput tapak eti—.

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ABOUT SPIDER COLLECTION.

BY

T. V. SUBRAHMANIAM.

(*With* 1 *plate and* 8 *text-figures*).

We look at a butterfly or bird with admiration and love. But the spider! the very name we abhor. Perhaps this dislike on our part is due to its lack of attractiveness or beauty. Volumes have been written about butterflies and birds but comparatively little interest is taken in spiders. Much remains to be done before we can have a complete list of them. The Morphologist with his books and microscope can name the specimen in his hand. But he has got a poor stock with him. He looks to the Field Naturalist to assist him with specimens. To his disappointment the collector brings him butterflies and birds, but no spider.

Our negligence, however, is not wholly justifiable. A study of the habits of spiders, of their infinite variety reveals a field of great interest. Their strategic ways of concealing themselves from their enemies and their perseverance in building their complicated webs are engrossing subjects. One who is interested in field Natural History, therefore, can well spend an hour daily in collecting spiders. Experience will justify that it is both an interesting and paying hobby.

For a better appreciation of this note I give below a short account of spiders and also some of the characteristics of a few of the main families which are commonly found in India. I have not attempted to give a comprehensive description of all the families. If the collector desires to know how spiders are identified he will have to consult some standard reference book such as the volume on *Arachnids* by Pocock in the *Fauna of British India.*

Spiders form a large Order known as *Araneae* under the Class of *Arthropoda*, the *Arachnida*.

They are distinguished by two characters: a round and unsegmented abdomen (except in *Liphistiidæ*) and a distinct waist between the cephalothorax and the abdomen. The cephalothorax is covered by a single dorsal shield—the carapace. The eyes are usually simple, six or eight in number, arranged in two rows, the anterior and the posterior lines. The arrangement and the disposition of the eyes are important in the classification. At the posterior end of the abdomen are two to four pairs of knob-like prominences, the spinnerets, with which the spider spins its threads. The mandibles or chelicerae are two-jointed with openings of the poison glands. The pedipalps in the males are modified to aid in fertilization into what are called Palpal organs. There is a marked sexual dimorphism in spiders: the females being larger than the males. The female spider lays a large number of eggs in a season all enclosed in a cocoon, which varies in size and shape. The young when hatched out resemble the parent except that they are minute in size.

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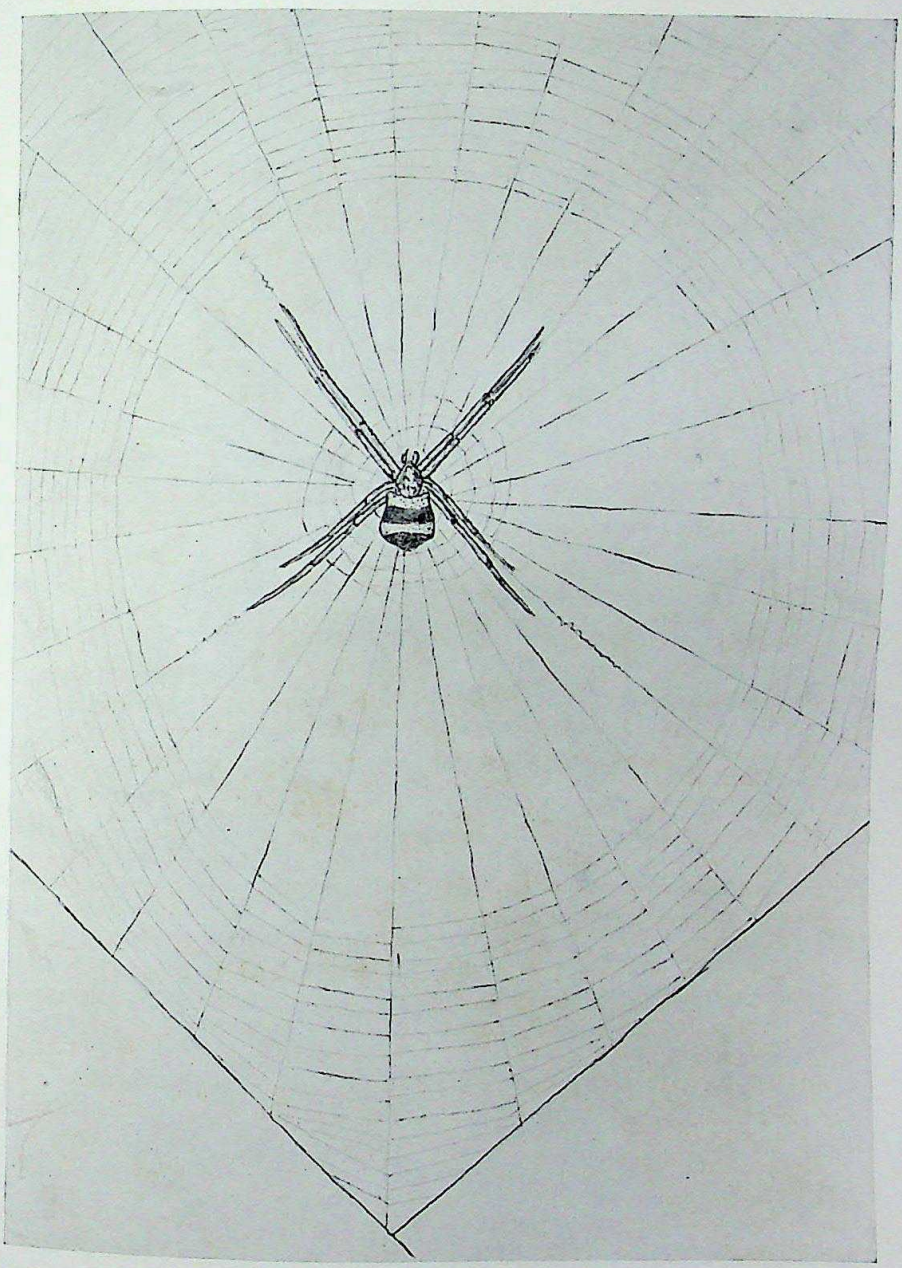

Argyope and its web.

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According as the abdomen is segmented or not the whole group is divided into two: *Mesothelæ* and *Opisthothelæ*.

The Mesotheles include a single family the *Liphistiidæ*. The tribe is distinguished by a segmented abdomen. They have aggregate eyes set on a distinct tubercle but this is not a characterstic possessed by the *Mesothelæ* alone. Some *Opisthothelæ* e.g. *Theraphosidæ* have also eyes set on a tubercle. The spinnerets are eight in number situated in the middle of the lower surface of the abdomen.

All the common spiders with which we are familiar come under *Opisthothelæ*. Here the abdomen is unsegmented and the spinnerets are six or less in number situated at the posterior end of the abdomen. There are two divisions under *Opisthothelæ*, the *Mygalomorphæ* and the *Arachnomorphæ*. In mygalomorphic spiders the basal segments of the mandibles project forwards from the fore-extremity of the cephalothorax, the articulation lying in a vertical plane. In Arachnomorphic spiders, on the other hand, the basal segments of the mandibles project downwards from the extremity of the cephalothorax the articulation lying in a horizontal plane.

Mygalomorphic Spiders.

Atypids.—Spiders with coxa of palp having a large maxillary process. Six spinning mamillae; carapace anteriorly broad with median conical ocular tubercle; large mandibles without rastellum; weakly-spined legs with three claws. They inhabit burrows in the ground.

Ctenizids.—Differ from the *Atypids* in the presence of a mandibular rastellum; coxa of palp without large maxillary process; only four spinning mamillae, anterior pair contiguous and posterior ones usually short; tarsi without ungual tufts. They are brownish black in colour and are common under stones. Some of them are trap-door spiders.

Diplurids.—Resemble *Ctenizids* in having three claws without ungual tufts. No mandibular rastellum. Again, posterior spinnerets are long and anterior ones widely separated.

Barychelids.—Medium-sized spiders (except one genus *Sason*) with mandibular rastellum (like *Ctenizids*) but unlike the two preceding families possess ungual tufts and only two weakly-toothed claws; spinnerets are like those of *Ctenizids*. They are burrowing in habit some being trap-door spiders.

Theraphosids.—Medium- or large-sized spiders differing from *Barychelids* in having apical segments of posterior spinnerets cylindrical and as long as the second segment; rastellum absent; eyes like those of *Liphistiidae* set on a distinct tubercle. Common under stones and in natural crevices.

Arachnomorphic Spiders.

Eresids.—Are small- or medium-sized spiders of dull white colour. Cephalic region of carapace wide and usually high with low clypeus. Four median eyes form a small quadrangle, narrower in front. Anterior lateral eyes on either side of the head, posterior ones far removed from rest. Mandibles flattish in front; fang-groove scarcely toothed. Maxillae inclined obliquely inwards; legs strong and weakly-spined. Abdomen oval. *Eresids* and *Psechrids* possess a spinning plate or cribellum in front of the anterior mamillae.

1. Eresid.

Psechrids.—Medium-sized cribellate spiders. Unlike the above they possess slender legs, anterior two pairs being longer than the posterior two. The tarsi with ungual tufts. Head moderately elevated with clypeus high. Mandibles strong and toothed below. Abdomen oval or cylindrical.

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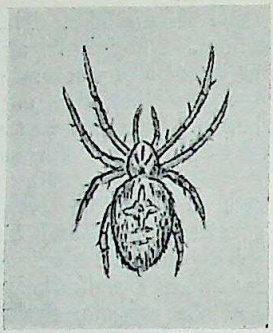
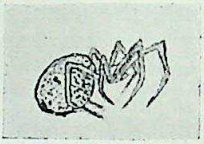
Hersiliids.—Hunting spiders found usually on the bark of trees and under stones living in irregular webs. Carapace as wide as long with cephalic region raised but narrow. Eyes of anterior and posterior lines both recurved; weak mandibles at most weakly-toothed below; maxillae inclined obliquely on labium; legs except third pair long and slender. Abdomen short. Posterior spinnerets very long; colulus or a mamilliform process present.



2. Argyopid.

Argyopids.—Sedentary spiders spinning geometrical webs. Carapace with clypeus low. Lateral eyes on the sides of the head typically close together away from the median quadrangle. Mandibles strong and movable and with strongly-toothed fang-grove. Maxillae not inclined on labium. Legs strong. Abdomen large and variable. Spinnerets subequal in length; a colulus is present.

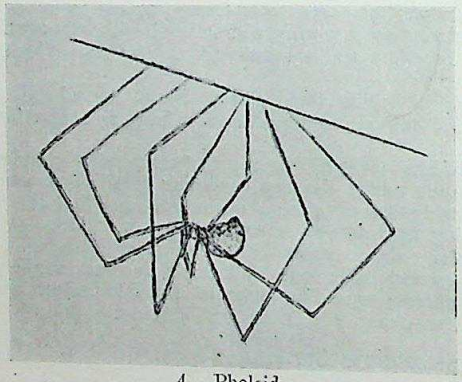
Theridiids.—Small spiders with oval abdomen. Differ from *Argyopids* by the presence of a set of spines forming a comb on the tarsi of the fourth pair of legs and by the untoothed fang-groove. Moreover the clypeus is usually high. Their webs are irregular.



3. Theridiid.

Uroctcids.—Carapace reniform, rounded in front and emarginate behind; eyes compact; mouth parts weak. Short but strong legs subequal in length with spines. Abdomen truncate anteriorly, oval behind; posterior spinnerets longer than anterior ones. A colulus is present. Anal papillae present furnished with a fringe of hairs.

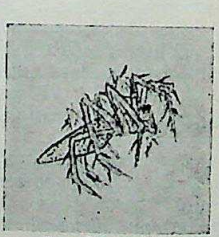
Pholcids.—Carapace flat and round with a distinct groove; clypeus high; head small and abdomen large. Anterior median eyes, very small, others large forming a group on either side of clypeus. Legs very long and slender. Common in corners of houses. They construct irregular webs.



4. Pholcid.

Lycosids.—Poisonous hunting spiders without a regular web (except *Hippasa*); carapace narrow in front, high. Eyes of posterior line recurved and large, anterior ones usually small and compact; mandibles strong and with toothed fang-groove; maxillae short not inclined inwards; legs strong and spiny; abdomen oval rarely elongate; spinnerets subequal.

Oxyopids.—Eyes form a compact subcircular group; anterior line recurved and the posterior procurved. Mandibles are weak and long weakly-toothed. Carapace oval and distinctly elevated; abdomen oval in front and narrowed behind; legs strong and spiny. Abundant in grass.



5. Oxyopid.

Attids.—Small-sized vagabond spiders without webs. They jump from place to place in search of insects. Legs strong; tarsi with ungual tufts and only two claws. Anterior median eyes very large, eyes of the posterior line forming a square on the sides of the head.

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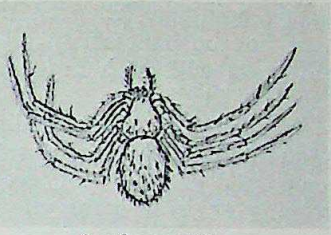
Clubionids.—Hunting spiders with powerful mandibles and toothed fang-grooves. Maxillae project forwards and not inclined on the labium. Legs strong and spiny with scopulate tarsi and protarsi. Ungual tufts present and only two claws. Anterior spinnerets in contact. Colulus absent. The carapace flat, usually wider than long; clypeus suppressed; the median eyes arranged in a recurved crescent. Tarsal claws unarmed (*Selenopineae*).

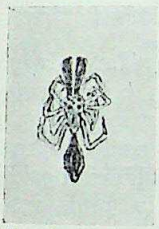
Sparassids (*Heteropodids*).—Differ from the above in having the carapace about as wide as long; the clypeus low; the median eyes forming a normal quadrangle and the claws armed with teeth.



6. Sparassid.

Thomisids.—Small spiders with weak mandibles weakly-toothed. The third and the fourth legs shorter than the first and the second. When chased or frightened they move sideways and are hence called laterigrade spiders. In the general shape they resemble crabs in miniature and are called crab-spiders. Many possess protective colours. Some are excellent mimics.

'Spiders being formed to a life of rapacity, their habits are calculated to deceive and surprise.' Being surrounded by enemies like birds, lizards and solitary wasps they are very dexterous by nature. Many possess various protective colours and so evade the collector's notice. Some are excellent mimics and the common *Myrmachene* is easily mistaken for the red ant. *Attids* and *Lycosids* are quick in their movements and easily conceal themselves. Altogether, the collection of spiders is not so easy a task as we expect it to be.



7. Ant mimic spider.

Luckily, spiders are ubiquitous. They live under diverse conditions: deep beneath the soil; in damp and moist places; in the scorching deserts and some even survive in hot-water springs. They have the power to withstand climatic and environmental variations. Locally they can be sought for in holes and crevices, in corners and along the walls of old houses, under stones and rubbish, along the bark and branches of trees, on the underside of leaves and in hundreds of other places.

No mathematically constructed or elaborate equipment is necessary in order to capture a spider, but only the overcoming of a natural repellance to these creatures and a keen eye. A medium-sized Kilner Jar (or any wide-mouthed bottle with a lid) containing some dilute spirit or formalin and a pair of forceps is all the equipment required.

Among the leaves of small bushes and trees many spiders hide themselves in search of insects. Shake a small branchlet of a tree or shrub with some force, and the spider if present either drops to the ground or hangs by its thread and toils to ascend upwards. Place the jar underneath and with a quick tap with the lid let the animal drop into the spirit. Replace the lid lest the animal escape. This is a method of capture usually practised by spider collectors.

Spiders which jump or run along the ground or stems of trees can, with a little nimbleness, be caught with the hand. Forceps

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may also be used to catch spiders but in so doing I have often failed and found my victim escaping from the forceps minus its limbs. A handkerchief, or a piece of cloth, will protect one from bites and the spider is better captured with the hands.

A butterfly net as is described in the *Bombay Natural History Society Journal*, vol. xxviii, No. 2, p. 509, is also useful in collecting spiders. The net may be a little stronger and its colour need not be necessarily green. A sweeping stroke among bushes and grass will fetch numerous specimens which can be transferred into the spirit jar.

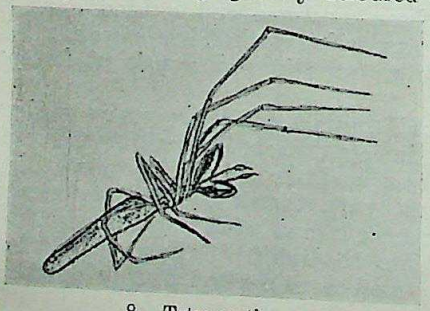
Members of the Family *Pholcidæ* are very common in unfrequented localities, in roofs and among rafters of old houses, in holes and hollows of trees—always remaining suspended and working their legs, at the slightest disturbance, like the Garden Harvestman (*Phalangium*). Their webs are of limited extension and irregular. But touch the web and the spider will try to escape you but it is not difficult to tap it into your jar. *Pholcids* as far as possible avoid bright sunlight and rain. They live confined in houses or in the shade of trees.

Members of the families of *Thomisidæ*, *Oxyopidæ*, *Argyopidæ* and *Clubionidæ* are usually arboreal: they can be collected in plenty in gardens.

Some *Thomisids* and *Oxyopids* live inside flowers and one may mistake their legs for the floral stamens. Such spiders besides protecting themselves from their enemies also easily prey upon insects which visit the flowers for honey.

No group of spiders constructs webs so attractively and with such geometrical precision as the *Argyopidæ*. Their prominent webs enable a collector to detect their presence easily. The webs are mostly octagonal and wheel-like in shape with a central hub or axis where the spider usually sits. From the central point various ribs radiate outwards and meet the external foundation lines. All the radii are further reinforced by concentric cross-threads. There is a fine description of the web of Araneus (*Argyopidæ*) and of the Giant Wood Spider, *Nephila maculata* (*Argyopidæ*) in the *Journal of the Bombay Natural History Society*, vol. xxviii, No. 3, p. 642.

Argyope is a gorgeously coloured beautiful spider belonging to this family. It sits in the centre of its spacious web. It is difficult to miss it. Other members like the *Tetragnatha* and *Argyroepeira* generally construct their snares among leaves of trees and plants, grasses or weeds standing near water. Many hide themselves on grass-blades or the green stems of plants stretching their legs in a linear fashion. At the slightest disturbance they run away or



8. Tetragnatha.

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drop down by their threads. Place collecting jar under the dropping animal and it is yours.

Members of *Sparassidæ* and *Clubionidæ* construct small silken webs on the undersides of leaves. Some roll up the leaves into a cylinder and live within. Species like *Playstes flavidus* and *Peucetia viridana* are green in colour and are difficult to detect among green foliage.

Attids are vagabonds and do not construct webs of their own. Generally they are all small in size about $\frac{1}{2}$ in. to $\frac{3}{4}$ in. in length. They are found everywhere: inside houses, on fences and in gardens. They are good jumpers and quick in movement. They leap from leaf to leaf and from plant to plant in search of small insects and spiders. *Attids* are exceedingly agile. Attempt to seize one and it will probably forestall you by jumping on your hand and with another jump disappear.

Eresids commonly construct irregular nets on bushes and branches of trees. The threads are white in colour and pasty to the touch. When disturbed they move very slowly along their snares.

The Common Indian Eresid is colonial in habit. Many live in a single saccular nest. The webs are generally constructed along fences or bushes bound about some of the twigs. The web resembles a cloth or paper irregularly folded. The size of the central house (the nest proper) varies according to the number of the members of the colony. There are numerous entrances to the house. Closely attached and forming a part of the nest there is usually an extensive sheet with strong foundation lines. This sheet is mainly intended to capture prey. I have seen an Eresidian web measuring about 3 ft. and whose foundation threads equalled ordinary twine in strength. It is a sight to see scores of *Eresids* pulling homewards an insect which has accidentally fallen into the net.

The collection of the colonial *Eresids* is easy. Tear open a net and shake the contents into the jar. You are sure to secure at least a dozen spiders. Solitary *Eresids* can be caught by the tapping method.

Of all spiders perhaps the most astute and cunning are the *Lycosids*. They cleverly escape the eye. Most of them are hunting spiders without proper abodes. The common *Hippasa*, however, constructs a tubular web by the side of stones among the leaf-whorls of pandanus, pineapple suckers etc., and by the buttress roots of trees. The tubes continue deep into the ground. Their mouths are strengthened by extensive additions of thread woven in irregular fashion. These spiders always sit at the mouths of their nests watching for visiting insects. At the sight of man they draw back into their deep retreat with astonishing rapidity. Unless the collector is as quick as the spider securing them is a difficult task. Even if caught with forceps the spider will leave its legs behind and save itself. The best way to capture one is to dig out the net, tear it open and catch the animal as it runs out.

Then there are spiders of the *mygalomorphic* group the most common genus being *Acanthodon*, of the Family *Ctenizidæ*. This

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spider lives under stones and rubbish. Its nest is generally a tube lined with silk, which (in all trap-door spiders) continues outside as a circular door protecting the entrance. These spiders can easily be detected by their dark colour and prominent abdomen. *Ctenizids* are bad runners and can be caught with the hands. The species *Acanthodon constructor* is common in Madras.

The spiders being killed when caught the next thing the collector wants to do is to preserve them. Sort out the collection and put the different kinds into separate tubes with slips of paper containing the following particulars:—(1) *Date of Collection;* (2) *Locality;* (3) *Collector's Name.* Close the mouths of the tubes with folded tissue paper. Immerse all the tubes in a big Kilner Jar containing light spirit or formalin.

A detailed description as to how a spider should be set and exhibited can be expected only from a Museum expert. In the Madras Museum the usual procedure is to fix the animal in its natural position on a mica sheet either with celluloid glue or in case of large specimens by stitching the legs and body of the spider carefully to the sheet. The mica sheet itself is inserted vertically into a glass jar containing spirit. Formalin may also be used but it hardens the specimens. The mouth of the jar is closed airtight.

There is no comprehensive list of all the existing species of spiders. If at all there are any they are in French. The only book that deals in a systematic way with spiders and is available to many is Pocock's Arachnida (*Fauna of British India*). A close examination of this book, however, will reveal that families like the *Attids, Thomisids, Theridiids* etc. are not entirely worked out. Among the living authorities on spiders I cannot mention but with gratitude the name of Dr. Gravely, Superintendent of the Madras Museum, under whose guidance I had the fortune to work for some months. His worthy additions to the Spider literature are of immense assistance to those who work in this line. He himself is an enthusiastic spider collector and there are many of his collections preserved in the Museum Laboratory. Our thanks are due to him for his excellent papers on *Clubionidæ, Sparassidæ* and *Argyopidæ*. He has supplemented and revised the old list of species. I am sure that a spider collector can get the most reliable and correct information regarding his or her specimens from the Madras Museum.

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AN APOLOGY.

In the December 1934 number of this *Journal*, in an Article headed 'Hunter's Moon', Mr. Randolph Camroux Morris of Attikan Estate, Billigirirangan Hills, Mysore, wrote what purported to be a review on Major Leonard Handley's Book, *Hunter's Moon*, published by MacMillan & Co. in March 1933, 22 months before.

We desire to state that this article came to the *Journal* unsolicited and that it was published as a contribution without full appreciation of the reflection it might involve on Major Handley. We do not associate ourselves or the *Journal* in any way with any criticisms of Major Handley conveyed by the article. Also if the publication of this Article has in any way injured the character, credit or reputation of the Author, Major Leonard Handley, we tender our sincere apologies.

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REVIEWS.

NATURAL HISTORY. Edited by CHARLES TATE REGAN, D.SC., F.R.S., Director of the Indian Museum, Natural History. 16 coloured plates and over a 1,000 photographs. Ward Lock & Co., London, 1936. 25*s*.

The term Natural History, to give it its wider meaning, is the study of the earth, the sky and the seas and all things animal, vegetable and mineral which they contain. But in the popular mind, it covers a more limited scope and is confined to the study of the Plant and Animal Kingdoms, or is limited more often to the study of Animals alone. The *Natural History* before us is a Natural History of Animals. Of the varying aspects of Nature, this is a subject which makes the widest popular appeal. The demand for books on Animals has been continuous. It has resulted in the production of numerous works which, in a single volume, more often in a series of volumes, have given in more or less detail an account of the Animal Kingdom.

But the progress of Science, exploration and research in various quarters of the Globe, are constantly throwing new light on various aspects of animal life and constantly adding to the sum of our knowledge. We are no longer content with discovering and describing new species of animals, though such discoveries particularly among the lower and no less interesting forms of animal life are constantly being made.

We are now more interested than ever in the study of animals under the conditions in which they live, their social and communal life, their relationship to each other, their adaptations to changing conditions, their food, their habits and their economic value. This study of animal life under natural conditions has brought out many new and interesting facts about them and has altered many previous conceptions. The data which the progress of Science has made available has rendered obsolete most of the existing works on Natural History. To provide, then, a comprehensive volume which would give a summary of present-day knowledge of the Natural History of Animals has been the objective of the present work. In these days of specialised knowledge, when scientists confine their study not to the great Classes of the animal kingdom, but to single family or tribe, no single man could deal authoritatively with so vast and complex a subject as Animal life in its entirety. It is a task which requires the co-operation of many scientists.

In producing this book, the publishers have been exceedingly fortunate in obtaining the co-operation of so distinguished a team of authors, each an authority in his special branch of zoology, who have contributed chapters to the book. The work of editing and presenting the picture as a whole has been carried out by Charles Tate Regan, the Director of the British Museum, Natural History. The result has been the production of an up-to-date compendium of concise information, accurate in detail, precise and scientific in its method of presentation. What is more important to the average reader, the book is written in a language which is intelligible. As such the book provides a good work of reference both to students and laymen. No popular work on Natural History would be sufficient without its complement of illustrations. There are 16 coloured plates in the book and more than a thousand photographs, most of them photos of animals under natural conditions. They reveal the great advance that has been made in Nature photography.

We recommend the book to any one who requires a readable and authoritative work on the Animal Life of the world.

S. H. P.

LES SERPENTS DE L'INDOCHINE. Par René Bourret. Two vols.; pp. 141 and 505. Toulouse: Henri Basuyau; 1936. Price Francs 40 and 110.

This excellent work will be welcomed by herpetologists all the world over; for, in addition to its high scientific standard, it presents a certain amount of originality in plan and treatment. The book is, moreover, clearly printed on a good grade of paper and its numerous illustrations—203—are above reproach.

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The first volume is of a general character and deals with the ophidian fauna of Indo-China. It opens with an historical account which is a remarkable example of patient and painstaking research. The notes on morphology and distribution, and the tables for identification—based on external characters only —are very good; but that which marks the book as an indispensable addition to Indian libraries and laboratories is the bibliography, so very detailed and complete as to make future work in Indian serpent lore not only easy but pleasurable.

By means of judicious cross references this bibliography enhances the value of the synonymy in the second volume, and infuses life into an otherwise dull subject. This second volume contains detailed descriptions of 203 species and 49 varieties belonging to Indo-China proper, and 92 species and 24 varieties belonging to adjacent countries. The descriptions, the synonymy and the identification tables are all that could be desired. The volume concludes with an index in which some 1,400 names are listed.

Orders from India ought to be sent to R. BOURRET, *Institut océanographique de l'Indochine, Nha Trang, Indochine Française, French Indo-China.*

J. F. C.

QUESTIONS AGRICOLES. Paris: Editions du centre polytechnicien d'études économiques—Document No. 5; 1937. Pp. 266. Price 15 francs.

At a time when the improvement of agriculture in India is being generally discussed the perusal of this book will prove useful to many who are animated with the best intentions but little realise the complexity of the problem to be tackled. Let it not be objected that this is the work of Frenchmen debating the future of agriculture in their own country; the fundamental principles of agricultural research hold equally good for every country in the world, and they are here laid down with characteristic French conciseness and clearness.

J. F. C.

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OBITUARIES.

A. J. W. MILROY.

By the death of A. J. W. Milroy, Conservator of Forests, Assam, on the 26th September 1936, was removed from our midst not only a man who had the cause of game preservation in India very close to his heart, but also one who introduced a new method of elephant hunting which revolutionised that art as practised in Assam.

Milroy's activities for the cause of Game Preservation in India are well known and he wrote much on the subject, but what is far better, he also translated his words into deeds. It is safe to say that no one knew the Kamrup or Kaziranga Game Sanctuaries as he did and it is also safe to say that no one will ever know them so well. During the activities of the far flung poaching organisation, financed by wealthy traders, which nearly wiped out the rhinoceros in these two sanctuaries in 1930, Milroy was indefatigable in launching a counter offensive which finally broke up the organisation and landed many of its members in jail. It is entirely due to him that we can now say that for the present these two sanctuaries are safe.

During his time as Conservator in Assam, a third Game Sanctuary has been added to the list. He was also instrumental in creating recently a buffalo sanctuary and it is hoped that his name will be perpetuated by having this sanctuary called after him.

It is not generally realised that modern methods of elephant hunting in Assam and the immense pecuniary gain the Assam Government has derived from this type of forest produce are due to this man who, by force of argument and personality, persuaded Government to allow him to try out his method which he had himself evolved due to his unique knowledge of that animal.

Prior to 1920, the hunting of elephants in Assam was in the hands of Assamese and Kampti Mahaldars, who paid a royalty to Government on each elephant caught. In these days it is difficult to realise, that the methods of only 16 years ago, involving the most unheard of cruelty to the animals, were ever tolerated for a moment. It is only charitable to think that the Government of those days did not know or did not realise that such cruelty existed.

A sketch of the methods of a native mahaldar, no matter how harrowing it may be to the feelings of those who love animals, must be given if the amazing transformation to modern methods is to be fully understood.

The method of catching elephants in Assam by which the herd is driven from a salt-lick to a stockade built nearby, or along one of their own paths into a stockade built astride it, is well known

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and Milroy himself wrote an illuminating article in the Bombay Natural History Society's *Journal* describing it.

In the old days it was thought by the native mahaldars that it was impossible to take *koonkies* into a stockade until the wild elephants had been weakened by hunger and thirst. Hence it was the practice to leave the herd in the stockade for anything up to a fortnight or even three weeks before any attempt was made to remove them. The condition of the animals after the lapse of such a period was beyond belief and cannot be imagined by anyone who has never seen it.

The interior of the stockade would be littered with the carcases of the calves killed by hunger, thirst or gored by maddened tuskers; the tails of the rest would have been bitten off. The picture of those left with sides fallen in, heads down and mouths open with blackened tongue protruding and covered with filth and blood would be a sight never to be forgotten.

Such was the condition of the stockade when the doors were opened and the sleek well-fed *koonkies* marched in and the captives were noosed. The wild elephants would be too exhausted to give any trouble in the stockade, but when dragged out the sight of the open jungle all around and perhaps some glimmerings of their life ahead would urge some of the stronger to make one last effort for freedom. Any attempt of this kind was promptly dealt with by the phandies, who slashed open the skin at the back of the neck where the noose fitted and rubbed some sand into the wound.

The tottering beasts were then dragged to the depot leaving a few more dead from exhaustion on the road.

Arrived at the depot the elephants were tied up fore and aft and the training proceeded on the principle that the more an elephant is hurt the sooner it learns obedience; hence spears were freely used. As may be imagined, the mahaldar did not engage any Veterinary Surgeon to look after the captures with the result that all abrasions went septic and the most appalling wounds, maggot infested, were a common-place.

Casualties during training were very high; as high as 48 per cent and for the whole catch might amount to as much as 80 per cent.

Such was the condition of elephant hunting in Assam when Milroy started his agitation after the War for more humane methods in hunting and training. He argued that a noble animal like the elephant would respond to kindness and humane treatment like every other animal, and that the methods hitherto in force could not be tolerated by any civilised Government.

He started on a small scale, and having become convinced of the truth of his arguments he obtained the permission of Government to conduct extensive hunting operations in the North Cachar Hills in 1920-22.

By his operations in the North Cachar Hills, Milroy at once revolutionised elephant hunting in Assam. In the two years, training casualties were reduced to 1 per cent and the total casualties to not more than 3 per cent.

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How did this come about? In the first place must come the man himself. Milroy possessed the most wonderful personality and charm of manner. He spoke Assamese—particularly the Kamrup dialect, extraordinarily well. His knowledge of elephants and of jungle life generally was such that few Europeans acquire and anything that 'Milily Sahib' said would be sure to be favourably, if critically, considered around the camp fires in the training depots.

Naturally when he said that no wild elephants were to be left in a stockade more than 72 hours the wails of lamentation rose to heaven. Further when he said that no spears were to be taken into the stockade the phandies broke down weeping and said 'we are already dead'.

It was characteristic of the man that he rode a *koonkie* into the stockade that housed his first catch. What must have been his pride as he saw all the elephants taken out without a scratch.

In the depot it was the same thing. A trained Veterinary Surgeon was always present and wounds were properly treated twice a day: no spears were allowed and anyone who used one got a lambasting with the handle thereof.

By the time the operations were over Milroy's method was a proved success and that success has been repeated over and over again in subsequent mahals. This method is now accepted as the only method to be followed in Assam and woe betide the Assamese mahaldar whose casualties exceed the prescribed minimum.

Among other benefits his method proved that elephants could be trained in a very short time; that cruelty was not at all necessary in training; that casualties in the training depot could be reduced to almost negligible proportions; and that an elephant trained by a mixture of firmness and kindness was in every way superior to a broken-spirited animal trained according to the former brutal methods.

When elephant hunting, Milroy was indefatigable. He drove with the drivers or acted as doorkeeper at the stockade, or as one of the stops and often bestrode an elephant as a phandie in training. In fact he knew the business from A to Z. He refused to accept defeat and on one occasion he drove a herd for seven miles only to see it break through the wings and escape. Most men would have been content to call it a day but not Milroy. He roused the disheartened drivers and conducted them off by a short cut to the place where his knowledge of the country led him to believe the elephants were making for. He headed the elephants and drove them back and succeeded in capturing the whole herd.

Like all animal lovers, Milroy himself shot very little. He was, however, most generous to junior officers and most of those in the Forest Service in Assam have to thank him for their first tiger.

A man of most singular charm with a great sense of humour he is sadly missed by his numerous European and Indian friends.

N. L. B.

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SIR GEORGE HAMPSON.

Sir George Francis Hampson, Bt., who died at his residence, Thurnham Court, Maidstone, at the age of 76, was a distinguished entomologist who was for many years on the staff of the Natural History Museum, London.

This is an ancient family descended from Henry Hampson, of Bradwell, Oxon, who was living in 1512. The first baronet, created in 1642, was Master of the Statute Office. George Hampson was born on January 14, 1860, the eldest son of the Rev. W. S. Hampson, rector of Stubton, Lincolnshire. He went to Charterhouse (Gownboys-Girdlestonites) in 1871, when the school was still in London, and left in 1875 for Exeter College, Oxford.

After taking his degree, he entered the Natural History Museum, South Kensington, in which he rose to be an Assistant Keeper. In 1896 he succeeded his uncle, Sir G. F. Hampson, Royal Scots Greys, who was a Crimean veteran, as tenth baronet. Sir George, who was a Fellow of the Zoological Society was the author of *Illustrations of Heterocera*, 1891-93, published by the British Museum, 'The Moths of India' in *The Fauna of India* series, published by the India Office, 1892-96, the *Catalogue of the Lepidoptera Phalaenae in the British Museum*, vols. i to xiii, and two volumes of supplement, 1898-1923, and *New Genera and Species of Noctuidae*, 1926. Hampson's volumes on the 'Moths of India', issued in the *Fauna of British India* series, were considered by him no more than a preliminary setting in order of a vast subject so as to reduce it to a workable state. To keep pace with the growth of the subject, which he dealt with in his work, he published a supplementary series of papers in the *Journal of the Bombay Natural History Society*. These papers were issued in 33 parts and were published between 1897 and 1911.

He married in 1893 Minnie Frances, daughter of the late Col. John Clark-Kennedy, of Knockgray, Kirkcudbrightshire; she died in 1928. They had, with two daughters, one of whom died unmarried, a son, Dennys Francis, who succeeds to the title. He was born in 1897, was educated at Eton and Christ Church, Oxford, and served in the Rifle Brigade in the War, when he was wounded.

DEV DEV MUKERJI (1903—1937).

We record with deep regret the death of Mr. Dev Dev Mukerji at Calcutta after a brief illness on the 21st of January, 1937. His death at an early age of 34 years is a great loss to Science. Of his several valuable contributions to Indian ichthyology, special mention may be made of the four reports which he published in the *Journal* of the Society. His exhaustive treatment of the Burmese fishes collected by Lt.-Col. R. W. Burton will ever remain a masterly piece of systematic research.

We extend our profound sympathies to the members of his family in their great loss.

S. L. H.

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MISCELLANEOUS NOTES.

I.—OBSERVATIONS ON THE GREY MUSK SHREW (*SUNCUS CŒRULEUS*).

It is commonly accepted that this common shrew is mainly insectivorous, but though it feeds largely on insects, it also includes meat, bread and other dainties from the human larder in its menu. It also feeeds on refuse and small creatures that it can overpower.

The distress call of a Bull-Frog (*Rana tigrina*), presumably caught by a snake, attracted my attention late one night. Out I went to investigate. On reaching the spot I was surprised to find that the frog had been caught by a Grey Musk Shrew (*S. cæruleus*). The shrew held the frog down firmly and was chewing at its spinal column at the base of the skull. To my mind, the shrew's capture of the frog, was due partly to the frog's 'foolish' habit of sitting still and partly to the agility of the shrew. A frog will often sit quite still and allow itself to be gently touched before it will leap away. The frog was about four inches from snout to vent and the tables might just as well have been reversed, as these frogs are quite capable of swallowing shrews and other small mammals. This statement is supported by actual experience. In the *F.B.I.* (Mammalia), p. 237, Blanford writes, 'Sterndale quotes from the *Asian* an account of a shrew that attacked a large frog.'

As nothing appears to be recorded (vide *F.B.I.*, l.c) of the breeding habits of this shrew, I mention such instances as I have observed. The main breeding season, in Salsette Island, appears to be during the monsoon months, when food is plentiful. I have taken naked young from the nest in June, half grown young in July and August, and females with fœtuses during July, August and September. The number at a birth varies from two to four the latter number being rarely, if ever, exceeded. A rude nest of dry leaves, paper, rags or other oddments is constructed. In the collecting of the nesting material both parents take part. At nesting time, shrews are particularly destructive; this I learnt to my cost as a pair of shrews destroyed some of my manuscripts and other papers, bits of which I later found in the nest. Outside the breeding season they do little or no damage. The nest is usually secreted in a corner among rubbish, in a trunk or in a drawer. It is surprising what a narrow slit will admit them. The young do not leave the nest till about three-quarters grown.

When unmolested, this shrew becomes quite fearless. During the rains one frequently visited my writing table while I was at it and collected the insects that were attracted to the light. The particular individual had two young in a box behind my table.

On the whole it is a useful creature about the house.

Bombay Natural History Society,
Bombay.
October 25, 1936.

C. McCANN.

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II.—BLACK TIGERS.

The *Evening News*, London, 10th October 1936, published an account received through Reuter's Agency, Assam, of 'a Black Tiger of the Royal Bengal Type' captured in a forest in Dibrugarh, Assam. According to Reuter, 'the Manager of a local Tea Estate set an iron cage with a bait inside. The tiger entered and was trapped'. The report adds that the animal 'was about 12 feet and is a rare specimen'.

The Conservator of Forests, Assam, requested by the Society to verify the report, kindly sent us a statement from the Accountant, Forest Office, Dibrugarh, who saw the animal after it was trapped, but was unable to get a clear view of it in its cage. The animal was trapped on the 4th September in the Nepaphoo Tea Estate owned by Bagchi Bros. of Dibrugarh and was subsequently sold to Messrs. P. K. B. Akuli of Barrackpore Road, Calcutta, dealers in wild animals.

Dr. Baini Prashad, Director of the Zoological Survey of India, Indian Museum, Calcutta, at our request made enquiries at Calcutta and was told by the present owner of the animal that it was a black leopard and not a tiger as described by Reuter.

The capture of a black tiger would have been an event! Though black tigers have been seen, in no single instance has a skin been obtained. Pocock in his monograph on Tigers (*J.B.N.H.S.*, xxxiii, p. 505) mentions three records of black tigers. One was the Black Tiger of Chittagong reported by Mr. C. F. Buckland in the *Field* (vol. lxxiii, p. 42, p. 789), whose letter was reprinted in the Society's Journal (vol. iv, p. 149). The animal was found dead and was too decomposed to remove the skin. The second was seen in 1913 by Mr. A. T. Hauxwell (*J.B.N.H.S.*, xxxii, 788) near Bhamo and was wounded by him but escaped. The size of the pug marks, 1 ft. 8 in. in circumference, indicated that the animal could not have been a leopard. The third record (*Field*, 1928, p. 656) is that of a black tiger found dead in the Lushai Hills, Assam. In this instance again the skin could not be saved.

In addition to these three records, there is a note by Col. S. Capper in our *Journal* (vol. xxiii, p. 343). Col. Capper when shooting in the Cardamom Hills, S. India, saw a black animal lying on a rock, which he examined through a telescope and which he believed to be a tiger. The presence of black leopards in the area where this black tiger was seen has given rise to doubts as to the correct identification of the animal—size being a very uncertain factor to rely on for the identification of an animal in the field. Similiarly, in the case of the black tiger seen and wounded by Mr. Hauxwell in Burma, it has been pointed out by Brigadier-General Burton in his book *Sport and Wild Life in the Deccan*, that the deceptive effects of light and shadow in the jungle frequently lead one to wrong conclusions regarding the colour of an animal.

The publication of Reuter's account referred to above of the trapping of a black tiger elicited letters from various correspondents which add further to the list of records of 'Black Tigers'.

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Captain Guy Dollman of the British Museum, Natural History, in a letter to the *Times*, 14th October 1936, says that he received information of two cases of melanism in the tiger. Captain Dollman says the first refers to a young individual shot in the Central Provinces some years ago. The specimen was of a dark brown colour all over, with stripes appearing black on the dark ground. The second case concerns an animal shot in 1915 by some natives in Assam, east of Dibrugarh. This black tiger is spoken of as being a magnificent animal. 'There can be no doubt' says Captain Dollman 'that the animals I have referred to above were tigers and not leopards'.

Commenting on Captain Guy Dollman's letter, Mr. W. H. Carter (*Times*, 16th October, 1936) writes "I was much interested in Captain Guy Dollman's letter on black tigers in the *Times* of October 14th, having been resident in the neighbourhood mentioned by him for years. In one of the official district Gazetteers of Bengal (Khulna or Backerganj) there is mentioned a local variety of tiger which had lost its stripes as camouflage in the open sandy tracts of Sunderbans. The uniform colour scheme adopted was however, brown and not black, but perhaps his cousin in the hinterland found black more suited to his background. The author of the *Gazetteer* in question is, I believe dead'.

Bombay Natural History Society,

January 26, 1937. S. H. PRATER.

III.—RAVAGES BY TIGER AND INCIDENCE OF MAN-EATERS IN NORTH COIMBATORE BETWEEN 1860 AND 1880.

Coimbatore District Manual.

Felis tigris—The tiger is an inhabitant of all the jungly parts of the district. Of late years, prior to the Autumn of 1873, he appears to have increased and multiplied to an alarming extent in some of the taluks, but more particularly in those bordering on the rivers Moyar and Bhavani. The Satyamangalam taluk has been notorious for several years as the 'locale' of man-eating tigers. One of these terrible pests (a tigress) was shot at Kongrapalaiyam, a village eight miles east of Satyamangalam, on the 16th of August 1879, by Major Davies, Superintendent of Police in the Coimbatore district, and another demon of equal atrocity (also a tigress) was destroyed by Captain Caulfeild and myself by strychnine on the 14th of July, 1873, a few miles to the north.

It is an error to suppose that all man-eating tigers are mangy, or that they become so in consequence of having acquired this evil propensity. Both the tigresses here mentioned, as I can testify from personal observation, were as sleek as a Derby winner. Mange and want of condition are consequent on age and its concomitant infirmities.

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In the Autumn of 1873, after our successful employment of strychnine, Captain Caulfeild was appointed tiger slayer to the presidency by the Madras Government. He at first confined his operations to the Coimbatore Collectorate (being ably assisted by the Collector, Mr. A. Wedderburn), and by means of poison, traps and other devices, he very soon materially thinned the ranks of the 'striped' family. In 1874, 93 tigers and 32 panthers were destroyed in the district. Only one man was killed, and the number of cattle destroyed fell from 2,183 in 1873 to 265 in 1874. These short statistics speak for themselves, and do not require any comment from me.

Mr. Wedderburn has very kindly furnished me with the following interesting particulars on the destruction of tigers, etc.:—

'The destruction of tigers was formally in this wise. When a cow or ox had been killed, the herdsman brought the intelligence; if there were shikaris in the village, they would go out, erect a platform of branches in a tree, or make an ambush of thorns on the ground, near the dead animal, and when the tiger returned about sunset they fired their long matchlock (with a barrel of five or six feet) loaded with a large charge of coarse powder and a bullet or two, and never missed their aim. In this way about twenty tigers were shot annually, but no great impression was made on their numbers, and the amount of cattle destroyed remained very much on an average. Occasionally by the intervention of the herdsman in defence of his cattle, he himself became a victim, and in this way one or two deaths occurred. But in one particular locality, under the hill range behind the town of Satyamangalam, a family apparently of man-eaters appeared. One, after committing great ravages, was shot by Major Davies, acting Superintendent of Police in 1869. After an interval of two years another appeared in the same locality, and was the terror of the neighbouring villages for nearly two years. The Magistrate of the District offered first Rs. 100, then Rs. 200 and finally Rs. 500 to any one who would shoot the pest; but it was much too wary to be approached. It carried off its man, partially eating him, and dropped him if pursued; and as the country was so difficult that it could not be beaten, it occurred to the Magistrate to ask permission to place strychnine in the body; but this was not approved of by the Government. Finally, however, this plan was adopted with success, and in July 1873 this scourge of the taluk was put an end to.

'The idea of poisoned baits then occurred as a good plan when the forest could not be beaten. Dr. Shortt, the Superintendent of Vaccination, suggested that the ointment of strychnine might be applied to a live bait, which, on being seized, would cause the tiger's death, but the plan did not succeed, the bait died of the ointment. Captain Caulfeild was appointed by the Government for the purpose of destroying tigers. As, however, his operations could only be conducted in one or two places at the same time, and the area of tiger-infested forest extended over some 200 miles, it occurred to the Magistrate of the district to ask Government to allow him to employ the headmen of all the villages in poisoning

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the carcases of cattle killed by tigers. It was in opposition argued that these village officers would destroy more lives by poisoning the cattle than the tiger had done, and a letter of warning was addressed to Government by an officer in a high position to that effect, but the Government did not appreciate the risk. So soon as permission was given, the Village Magistrates were supplied with small phials duly sealed, each containing six grains of strychnine, and were directed, so soon as the village herd reported a kill, to repair to the spot before sunset and apply the poison. The result was, that in fifteen months from the time of the plan being sanctioned, poison was applied in seventy cases, and thirty tigers were found dead near the baits, the others which had eaten disappeared; occasionally their remains, totally decomposed, were found at considerable distances, showing that though death had not been immediate, the animal had ultimately succumbed to the effects of the poison. Several tiger cubs were taken alive after vain search had been made for the dams which had eaten the bait. But the best proof of the effective remedy which had been applied was in the decrease in the losses of cattle—a matter of great importance to the ryot cultivators, who can ill afford to lose their cattle on which their cultivation so much depends. The losses of cattle fell in the short period of 15 months from 2,000 to a tenth of that number, and thus from £1,500 to £2,000 value of stock was saved to the people. The Government viewed this success with approbation.

'That with such extensive forests the race of tigers will ever be exterminated cannot be expected, but the number is reduced proportionately with the game on which they used to subsist while the number of guns now used by the people, who shoot in season and out of season—watching in the hot season by water-holes at which the poor animals of the forests and hills come to slake their thirst, and at salt-licks in the rains which are equally attractive—have greatly reduced their numbers. The common food of the forest tiger consists of wild pigs, which are most destructive to cultivation, so the tiger is not without its use in the animal economy, but it is not interfered with till it turns its attention to the villagers' cattle, and then its first meal frequently proves its last.'

Felis jubata (the cheetah)—This animal is only sparsely distributed over a small portion of the district bordering on the river Bhavani, about Vellamundi and Kotamangalam, where it preys on the antelope which abound in the vicinity of those places. Colonel Davies informs me that about four years ago, in looking over some skins of wild animals that had been killed in the district and sent to the Collector's office at Coimbatore, he saw five good skins of the *Felis jubata*, and that his impression at the time was that 'they came from the low hills about Kotamangalam'. 'I was surprised,' he continues, 'at finding the leopards' skins among the panthers', as I had not heard that *Felis jubata* was found in the district. The skins were in good order and undoubtedly those of *Felis jubata*.'

Mr. Wedderburn also informs me that he has seen skins of the

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hunting leopard at the cutcherry, and I think he has one in his possession now that was obtained near Bolampatti.

1623 to 1672—During this period the Compiler of the Manual states that wild beasts were so common, especially in the forest taluks, that one missionary lost thirty of his acquaintance within six months by their ravages.

HONNAMETTI ESTATE,
ATTIKAN P.O., *via* MYSORE. R. C. MORRIS.
September 27, 1936.

IV.—TIGER SMOKED TO DEATH IN A CAVE.

Tigers had been reported to have caused considerable loss and annoyance with their predilection for village cattle at several villages in Upper Burma. So persistent were their depredations that they caused the D.C. of the district to take notice and to issue an open invitation to sportsmen generally. Several parties visited the area, I was also tempted to help. I fear most were disappointed, but as is well known, news of tigers cannot be supplied or obtained with any accuracy or speed to enable sportsmen to be sanguine of success or even of getting a possible shot.

On arriving at the villages mentioned in the invitation I gathered that no recent news of tiger or kills had been received and that the tiger or tigers had left the neighbourhood.

However having arrived, I elected to stay a few days to look around and await possible news. Late one evening I heard casually that a tiger had attacked two bulls killing one outright and so severely mauling the other that it was not expected to live.

This occurred in a village several miles from where I was camped. Very early next morning, I proceeded to the scene of the kill and was just in time to see the carcase of a full grown tiger measuring between pegs 8 ft. 6 in., being carried out of a cave in which it had been asphyxiated that night with wood smoke. It was in its prime and in excellent condition. No part of its skin or teeth being damaged in any way.

The circumstances and procedure were as follows, and may interest your readers. The tiger had attacked and killed one of two bulls within 100 yards of the village, and then dragged the dead bull into a nullah and dined off a considerable portion of the carcase. It began its meal with the hump which was unusual!

Early in the morning the villagers led by a young man of 26, traced the foot prints to a cave or tunnel in the nullah further away. This tunnel was situated in a sharp bend of the nullah. It led through a promontory projecting on the nullah. The opening on one side was large enough for the tiger to enter, while the other opening was too small and narrow for the animal to escape. The entire tunnel measured about 30 ft. The villagers blocked the larger entrance with thorn bushes cut and collected in the

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vicinity, and put cross-pieces of young trees 3 or 4 inches in diameter, holding these in position by forked pieces 10 ft. long planted strutwise. The smaller opening was blocked up with rocks and earth leaving sufficient opening to fan in the smoke from a fire from a large pile of dried wood. This asphyxiated the tiger, but it was fortunate for the villagers that it 'was' dead when they opened the cave to ascertain the result of their labours. Pluck, coupled with fool-hardiness and luck is the only conclusion one can arrive at for the success of the enterprise. Had luck not served them some of them would have been hurt to a certainty.

18 Churchill Road,

Rangoon. S. A. CHRISTOPHER.

October 16, 1936.

V.—TIGER LORE IN BURMA.

While sitting in the village an 80 year old Burman repeated to me a Burmese rhyme which I immediately recorded and I send it you. It is exceedingly interesting to me and it may interest your readers.

Kyaung a kyi—Gaung ga cie.
Thit a lat—Kha gah hpyat.
Kya a htwai—Hpin ga lway.

Literally translated is as follows:

A large cat—rides the head (begins meal at the head).
A medium leopard—cuts the waist (begins meal at the waist).
A small tiger—munches the stern (begins meal at the stern).

This is an allusion to the well known habit of the leopard commencing its meal with the stomach, while the tiger usually begins with the hind quarters of the kill. This must have been known to ancient Burmans long before successive sportsmen have come to the same conclusion.

The Burman believes that you are likely to get into trouble if you make a mistake in your food or the way you eat your food. The expression is *'A sa hma the'*.

The unusual way the tiger referred to in the note above began its meal, according to the wise old man, was a sure sign that it was to meet its death.

Another expression or legend known to ancient Burmans is the saying 'if a tiger had to depend on its nose (i.e. sense of smell) it would starve to death.' The controversy as to the acuteness of the sense of smell of the carnivora still goes on amongst sportsmen.

18 Churchill Road,

Rangoon.

S. A. CHRISTOPHER.

October 11, 1937.

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VI.—YOUNG ELEPHANT KILLED BY A TIGER.

While on a shooting trip in the Cochin State during December 1935 I found a young elephant, 39 inches in height at the shoulder, which had been killed by a tiger.

Young elephant killed by a tiger.

The tiger killed the elephant near a swamp. It is difficult to say if the elephant was one of a herd or merely accompanied by its mother. The area in which the killing had taken place consisted of large clumps of bamboos, the surroundings were much trampled by elephants and numerous bamboos pulled down by them while feeding. It is possible that the young elephant was alone when attacked by the tiger.

It was killed by being bitten on the back of the neck. There was a large flap of skin torn back which may have happened when the tiger was shaken off. The shoulders and back were also marked by the tiger's claws. After being killed it had been dragged about fifty yards down a slight gradient and was hidden at the foot of a bamboo clump in such a manner that it would have been difficult for it to have been seen by vultures.

The elephant, according to my Kardar trackers, had been dead about three or four days and the tiger had been feeding on the two back legs and the saddle.

The kill was discovered by my seeing the tiger lying practically on his back and asleep at 9-30 in the morning. I fired at him with my .500 cordite, but due to the position he was in, the bullet was not immediately fatal. The tiger was able to struggle up and made for dense cover, where he could be heard breathing and

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in a bad way. He was left to die but during the night had made for water and entered a very thick piece of jungle into which it was impossible to follow up.

He was subsequently found dead and I had the skull and claws sent to me. The skull measurements showed him to be approximately 9 ft. 9 in. length.

TANJORE. C. H. BIDDULPH.

December 30, 1936.

VII.—THE RESULT OF EXCESS POISON FOR WILD DOGS.

Wild Dogs have recently been killing cattle and calves to an alarming extent here; 'Atlas' poison was accordingly issued out to the herdsmen with careful instructions as to its use. Soon after this another kill occurred and the herdsmen, instead of pouring a little of the poison diluted by 50 per cent water into deep cuts and jabs all over the carcase as instructed, splashed the 'Atlas' neat over the kill thinking the results would be much more of a certainty. Seeing the herdsmen retire the dogs (a pack of twenty returned and fed, and in a few moments were staggering about obviously very sick; all the dogs were then seen to vomit up the meat they had devoured, and they then lay about with every appearance of feeling most uneasy. In about an hour however the pack got to their feet and straggled away, seemingly little the worse. Some days later the decomposed remains of one dog were seen, but the remainder apparently recovered and have been seen frequently since but appear to be fighting shy of cattle! This is a good example of the use of an excess quantity of poison on carnivoræ, be it arsenic or strychnine. It is essential to use the poison both diluted and sparingly. I lost a herd of 24 buffaloes through their being allowed to graze on my boundaries where the undergrowth had been treated with diluted 'Atlas' Tree-killer. A Planter in this district lost cattle through painting posts in a shed with 'Atlas' Wood-preservative, and cattle have been killed both in South India and Burma through their coming in contact with spots where skins had been treated with 'Atlas' Skin-preservative; in every case the material treated with 'Atlas' being licked by the unfortunate animals!

HONNAMETTI ESTATE,

ATTIKAN P.O., *via* MYSORE. R. C. MORRIS.

November 9, 1936.

VIII.—THE STRIPED HYÆNA AS A MAN-EATER

The *Times of India* of the 11th July 1936, contained a report from a correspondent at Mainpuri, U.P., describing the depredations of a 'pack' of Hyænas which were said to be attacking and killing people in the Mainpuri District, U.P. In India, no authentic cases of Hyænas attacking and killing human beings have been

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recorded; further, as the instance of the Striped Hyæna—normally a solitary animal—hunting in packs appeared unusual, the Society referred the newspaper report to the Chief Conservator of Forests, U.P. for enquiry. We have since received from Mr. F. W. Champion, Deputy Conservator of Forests, U.P., a report on the incident by the Tahsildar, Mainpuri, forwarded to him by Dr. S. S. Nehru, I.C.S., Collector, Mainpuri.

The Tahsildar's report reads as follows:—

'With reference to letter No. 144/XXV-5, I beg to state that the animals referred to in the above letter are really hyænas and not wolves. The animals are striped and quite different from wolves.

'They were reported in an open area between Ali Khera and Jagatpur, Tikri and Hatpau villages in Tahsil Bhongaon.

'They killed a girl at Partapur and another girl at Sultanganj —both in Tahsil Bhongaon. Two Hyænas were killed—one at Tikri by thakurs with gun and spear and the other near Rampura by Banjaras. The latter were rewarded Rs. 10 by the District Magistrate.

'A third was killed by the Kanjars of Mainpuri at Saidpur Baghauli in this tahsil which adjoins tahsil Bhongaon.

'It is said that they are still near Tikri.

'Tahsildar Sahib Bhongaon had seen the killed animals. I have also seen one killed in this tahsil.

'It is called *Charkh* and *Lakar bhagga*. The head and the face of the animal were round.'

Pursuing the enquiry further we received the following report from the Superintendent of Police, Mainpuri:—

'The only case in which the animal or animals were actually seen taking any child away was that of a woman who was working outside in a field. She left her child lying on the ground and was attracted by the cries of the child. She looked up and saw an animal taking the child away in his jaw. She ran after the animal and rescued her child after a great struggle. She described the animal as one exactly tallying with the description of a hyæna. She was later on shown a dead animal and the skin of one and she confirmed the first impression. This does not leave any doubt in the matter, though this is the only sure testimony on the subject. Hyænas were killed and shot in a large number here after the reported outbreak, as the reward for their heads was increased after the reported incidents. The newspaper report published in the *Times of India* was not quite correct in details. For instance there is no evidence to the effect that the animals in question were seen in packs by any one. It is a common knowledge that wolves attack human beings only in packs and they move from one place to another very quickly. Wolves are known and recognised by every villager and the woman in question seems to be quite definite that it was not a wolf in her case, and also that the animal was alone when she saw her child being taken away.

'I personally think it was a Hyæna.'

The facts recorded above appear to provide evidence of a Hyæna attacking human beings and, at least in one case, the animal was

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seen carrying away a child. This is as far as we are aware the first authentic instance.

In India, the Striped Hyæna is a scavenger by habit though it occasionally attacks sheep and goats and more often dogs. In Africa, the Striped Hyæna appears to be far more aggressive. Writing of this animal in his *Somali Book*, Captain A. H. E. Mosse says that he was told by his shikari that it (the Striped Hyæna) will run amok amongst a herd of sheep and goats killing a dozen or more from sheer lust of slaughter'. He hardly credited the story at the time, but it has since been corroborated by Drake-Brockman (*Mammals of Somaliland*), who says that it is always an old animal that acts in this fashion and is then given by the Somalis the distinctive name of *Whera*, the usual Somali name for the Striped Hyæna being *Didhar*; while the Spotted Hyæna (*Crocuta crocuta*), a far more aggressive species, is known as *Warba*. This species according to Drake-Brockman frequently attacks human beings sleeping out in the open and sometimes attacks children.

The case of a Striped Hyæna attacking children as recorded above is probably an individual trait developed or developing in a particular animal. It may have been induced, as is frequently the case with man-eating tigers and panthers, either by the chance killing of a human being or from difficulty in finding food for the cubs.

Bombay Natural History Society, S. H. PRATER.
6, Apollo Street, Bombay.

IX.—A VERY LARGE SAMBAR STAG.

I yesterday shot from the Billigirirangan Hills, a Sambar stag (*Rusa unicolor*) carrying a very good head, measuring 38 in. and 36 in., one antler being 2 in. less. The horns were about a week or 10 days out of velvet; again this year Sambar are in hard horn early, but not so early as last year when many were in clean horn in August.

It was not so much the size of the head but of the animal's body that astonished me, it was unusually large as the following details will show:

Weight (ungralloched): 776 lbs.
Height at shoulder: 5ft.
Length of body: 7 ft. 4 in.
Length of tail: 1 ft. 2 in.

These measurements indicate an immense Sambar, which indeed it was. Dunbar Brander, in his *Wild Animals in Central India*, refers to another 'quite exceptional' Sambar weighing 707 lbs., measuring 59 in. at the shoulder.

Honnametti Estate,
Attikan P.O., *via* Mysore. R. C. MORRIS.
September 22, 1936.

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X.—A BIG BUFFALO HEAD.

Seeing the measurements of a bull buffalo (*B. bubalis*) horn by Mr. Griffith I send you the measurements of a head in my possession which is as follows:—

Length on outside curve	Circumference	Tip to Tip	Widest inside	Widest outside
64¼″	19⅞	64	67	——

I acquired the head from the estate of the late Mr. Victor Iden, who was a relative of the Van Ingen family of Mysore. He was a keen shikari and before his death I very often accompanied him on shoots. In all probability he got the head in the Irrawaddy Delta in the neighbourhood of Kadonkani or Abya as I know he was a constant visitor to these parts. I regret I never got the particulars from him.

RANGOON,
September 23, 1936.

S. A. CHRISTOPHER,
BAR-AT-LAW.

XI.—GAUR BULLS ATTACKING A WOUNDED BULL.

An extraordinary sight was witnessed by Captain Napier (of Bangalore) and myself on the 22nd November 1936. Captain Napier had wounded a bull bison (*B. gaurus*), which prior to this had been 'milling' with two other bulls in the same herd, the breeding season being on. Far from taking afright at the shots the two bulls rushed up directly they saw their late antagonist fall and gave the unfortunate bull a very bad time as it attempted to rise; the rest of the herd also trotted up and stood around, interested spectators. On our approach the bulls and herd showed no haste in their departure, leaving the scene obviously reluctantly.

I have heard of similiar instances occurring in connection with stags in the rutting season; and have actually had two bull bison pass me within a few yards (both saw me), engaged in a running fight, without doing more than swerve aside, so wrapt up were they in their own affairs; here again during the breeding season.

HONNAMETTI ESTATE,
ATTIKAN P.O., *via* MYSORE.
December 3, 1936.

R. C. MORRIS.

XII.—WHIPSNADE ZOO.

The Whipsnade Zoological Park has made steady progress since 1932 (vol. xxxvi, No.4, dated 15th December 1933) and members may be interested to have this supplementary account, the outcome of a visit by the writer in July of this year—1936.

It is not only within the Park that changes are apparent, for the attractions of the Zoo and the very favourable elevated site,

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are together causing development in several ways. On the north-western slopes of the Downs, where the great White Lion which is two hundred yards long affords a striking landmark, the planes of the London Gliding Club can be seen gracefully quartering the hillside like giant birds of prey; and along the main road just below are the beginnings of a Bungalow Town, complete with Golf Course and Club. Near by is the Dunstable Swimming Pool and the Whale Cinema. It is to be hoped this new Garden City will not become too large, and that ribbon building now in progress will be kept within reasonable bounds.

The number of animals in the Park is now near 3,000 and includes elephants, lions, tigers, bears, wolves, wild dogs, hunting leopards, bison, zebras, giraffes, large Indian rhinoceros, pigmy hippopotamus, llamas, wild horses, deer and antelope of several kinds, several species of cattle, kangaroos, wallabies, monkeys, chimpanzees, ostriches, emus, storks, cranes, and many of the smaller mammals.

A few of this host of creatures are necessarily kept in roomy fenced enclosures, or otherwise restricted in movement, but many are free to roam where they will within the beautiful five hundred acre estate. Such are the Chinese water deer, swamp deer, muntjac, kangaroos, wallabies, wild turkeys, cattle egrets, guinea fowl, and various species of pheasants and partridges; red and blue macaws, tame as any caged parrot, fly about without thought of wandering afield, and the indigenous Red Squirrel may be seen living at peace among his native firs.

Apart from the above most of the animals are in such large enclosures and paddocks that their movements are little restricted. It is a commonly expressed criticism of the Park that owing to the size of the enclosures the animals cannot be closely observed. Animals should not be thrust into a cage to be stared at from every angle. They should not be exhibited unless they can be observed in as close approach to their natural state as possible, and the first consideration to this end is space. It has been found at Whipsnade that even exotic creatures can live, thrive, and breed if given ample space and shelter in bad weather. Two of every kind there should be as it is certain that animals feel loneliness. Solitary confinement is a punishment much dreaded by human beings, and in a scarcely less degree it is a cruel infliction upon the unoffending creatures behind the bars. If visitors to Whipsnade allow sufficient time it is possible to view all the animals at sufficiently close quarters. Let those who like to see animals in cages go to the Zoo in London.

The Official Illustrated Guide gives a great deal of interesting and general information, including two suggested itineraries for visitors. Taking much the same walk as four years ago the new Elephant House at once attracts attention. Here are four elephants in circular glass-roofed stalls, each having access to a bathing pool. The building is in the modernist style and wholly suitable to the housing of the animals while at the same time not unpleasing to the eye, standing as it does with green lawns in front and backed by the greenery of firs. The attendants have excellent

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control over their charges by use of ordinary ash walking sticks instead of the iron driving hook of the Indian elephant driver. They have taught the animals several tricks. If you give the animal a coin it will not be surrendered to the keeper until a biscuit is tendered in exchange!

Near the elephant house is the new enclosure for hunting leopards now occupied by a pair of these easily tamed, handsome creatures. Close to it is a buffalo enclosure under construction, as also one for white-tailed gnus. During 1937 work will include the surrounding of 7 beech trees by a moat of water, so making an island for gibbons; and there will also be an enclosure for wild pig and wart hogs.

Tarzan Tree has been wired in to make a happy home for a number of Rhesus monkeys, and not far away is an island on which four young chimpanzees give a non-stop entertainment to delighted onlookers by their ceaseless antics. On the island are two bare limbed trees connected by a much used tight rope, and a monkey puzzle tree the ample foliage of which attests to the fitness of its popular name. The gift of a few pieces of cloth largely contributes to the merriment of the show and the obvious delight of animals and spectators alike.

The wild dogs have been moved to an enclosure near the wolves, the space so available being now a picturesque island and pond for flamingos and various species of waterfowl. It is good to note that the Tibetan mastiff is no longer 'exhibited'.

The tiger chalk pit is successfully used as a breeding enclosure while the new Tiger Dell gives to four of those animals the amenities of trees and natural ground, with sleeping shelters and a bathing pool. The four male lions afford a grand spectacle at feeding time. They have formed two pairs of pals. The lion which killed the man who ventured into the enclosure to retrieve a hat in 1933 is growing old—his head has a palsy shake and his jaw hangs loose, so at feeding time he is bullied by the opposite pair. It is obvious he is afraid to mingle with the others when the meat is coming along, and the slightest sign of an advance is met by roaring rushes and angry demonstrations. Then begins the spectacle of his pal savagely protecting him by charging at the aggressors. With teeth and claws a-bare he shoulders them off, rolls them over, tears out tufts of yellow fur, and it is only the distraction of the keeper's arrival with the meat which separates the furious combatants. Then each lion has his share—the old fellow last of all, and peace reigns—until next feeding hour!

Giraffes have a new roomy shed and enclosure near to which is a field in which the Great Indian Rhinoceros presented by the Prime Minister and Commander-in-Chief of Nepal leads a well fed and well bathed life of ease.

In Dagnall Paddock are yak, and in the long grass of Lay Meadow the sika deer of Japan and the sambar of South East Asia run almost as naturally free as in their native wilds; among them stalks the Sarus Crane. In the spacious Round Close, nilghai roam at ease with the Indian antelope which chase and display graceful high bounds just as they do in the plains of India.

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By the side of the road near the Polar Bear enclosure is a toposcope dial, presented by Sir Chalmers Mitchell, giving the direction and distance to some twenty-five chief towns and villages.

One of the chief charms of Whipsnade are the open grass downs which afford such delighful walks. There is a grand panoramic view over the country, and if time permits a walk to the top of Ivanhoe Beacon will well repay the slight effort entailed.

This short account may well close with an extract from the Official Guide, for it so aptly sets out the aims and objects of the Society as to the future development of this spacious Park, which is the largest and best appointed of its kind in the whole world at the present time. 'The Society was a century old when it bought Whipsnade Park, and it proposes to develop it not as an ephemeral exhibition, but, slowly and surely, as a permanent addition to the beauties of England. It will be content if, at the second centenary, in 2029, its wise foresight will be applauded and its plans prove to have been well and truly made. Ultimately, it is hoped, every wild plant, tree, shrub or flower native to the chalk downs, upland pastures and rough woodland, will flourish; every British wild bird, resident or migrant, that the district suits will find itself in sanctuary, and the animals which have been introduced from other countries will live and breed in almost natural freedom, separated from the visitors not by visible bars and fences, but by ditches which do not offend the eye, and with concealed shelters, warmed where necessary by electric heaters.'

By road or by rail Whipsnade is but thirty-five miles from London so all who go to England should not fail to see it.

R. W. BURTON, Lt.-Col.

XIII.—DO BIRDS EMPLOY ANTS TO RID THEMSELVES OF ECTOPARASITES.

The day after I had read Mr. Salim Ali's very interesting note on the above subject in Volume xxxviii, No. 3, p. 628, I had the good fortune to watch a Song Thrush 'anting' itself—to borrow the term Mr. Ali suggests.

My wife and I were walking along the Sandgate Road in Folkestone, Kent, when the peculiar antics of the bird drew our attention. Although we approached to within six or eight feet, it continued to bathe in red ants which were issuing from a crack in the flags close to the railings. Not only did it pick up one, two, or sometimes three ants in quick succession and stuff them in between the tail feathers, into the tail-coverts, primaries, and under the wings, but, with tail and wings outspread, it often wallowed amongst the ants which could be seen swarming all over it.

It did not appear to me to be swallowing the ants, and I could plainly see many motionless dots adhering to the plumage which I feel certain were the squashed ants rubbed in by the bird. We watched the performance for six or seven minutes, until the

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bird hopped back through the railings on the approach of another pedestrian. Incidentally, it appeared to both of us to be in rather poor condition.

MEERUT, R. S. P. BATES, MAJOR.

January 8, 1937.

XIV.—SOME RARE BIRDS IN NORTHERN BURMA.

The following birds were obtained in 1935-6 in the Myitkyina district and the skins identified by Dr. C. B. Ticehurst, whose notes on them are given in square brackets.

Pomatorhinus ochraceiceps. Austen's Scimitar Babbler. According to the *Fauna*, no race of this Scimitar Babbler is known between Karenni in Eastern Burma and Eastern Manipur. My skinner Lazum Naw, shot a male on March 8th, 1936, on the hillside below Laukkaung military police post, at about 4,000 ft. The iris was straw yellow with an outer ring of pink and the bill salmon-colour. [This bird matches the only two *austeni* in the British Museum, both of which (one is the type), came from Aimok, Manipur. There are seven specimens of *stenorhynchus* from Tengi Pani, Naga Hills, and Tippook. *Austeni* seems distinct in being greyer and paler above, and in having the flanks greyish-buff instead of warm-buff, but better series of both, and more knowledge of their distribution, are required.]

Sphenocichla roberti. Robert's Wedge-billed Wren. My skinner, above mentioned, shot one on the same hillside out of a party of three on March 8th. He showed me the place a little later, a bamboo clump at about 4,300 ft. on the edge of a small dry ravine. The birds were in a comparatively open patch, whence firewood had been cut, and disappeared into the depths of an extremely precipitous and heavily forested evergreen hillside, which I later attempted to search twice without success. The hillside, in fact, is as difficult and impenetrable as anywhere I know in the Kachin Hills. I made notes of the soft parts at the time: iris very dark red, bill, upper mandible brownish-horny, tip gray, lower gray, blue-gray nearer nape, legs and feet dark chocolate-brown, claws horny brown. There are no previous Burma records, but it has occurred in North Cachar and Manipur. [There are only four specimens of this species in the British Museum from Konchung Peak, Manipur and Hemeo Peak, Naga Hills. Little is known about it.]

Turdus merula albocinctus. White-collared Blackbird. I shot a female on February 11th, 1936, about 5 miles from N'Ding in the Hukawng Valley. I had previously, with glasses, had a view of what I was sure was a male near the same place. In this part of the Hukawng Valley, the new cart road runs for miles

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through magnificent evergreen forest with an undergrowth of ferns. The most noticeable features of the bird life were the numerous thrushes, *Oreocincla dauma* and *mollissima* and *Turdus dissimilis* all being obtained as they came out on to the road. This is the only record of this species in Burma. [I see no reason to suppose that this is a race of *merula* as described in the *Fauna*.]

Prunella immaculata. Maroon-backed Accentor.

Lord Cranbrook got specimens in the Adung Wang in 1931, and I had one sent me from the Laukkaung neighbourhood in March 1934. In March 1936 I found it common in pairs and small parties between miles 62 and 64 on the Seniku-Hpimaw road, where the mule track has been cut out of the solid rock, and paved with moss-grown rock. The accentors were either hopping up on the rock face or feeding among fallen leaves and brushwood on the edge of the khud. They were not at all shy and might have been mistaken for tree pipits as they flitted up into the bushes. At close quarters the gray head, maroon back and dark red under-parts are most distinctive. This must be a very local bird, as I saw 15 to 20 in about a mile of this particular section.

Delichon nipalensis. Nepal House Martin.

Mr. A. K. Thomson, Burma Frontier Service, sent me a skin of one shot by him on January 2nd, at Sumprabum (4,000 ft.), about 120 miles north of Myitkyina. He wrote 'A large number of them made their appearance—they disappeared in the evening. Snow has been visible on the Kumon range for the last three days and I fancy the extreme cold has driven the birds down here'. There is only one previous record of one obtained by Major Mears in the Upper Chindwin (date and locality not mentioned). [Besides Mears' record J. C. Hopwood has stated that this species breeds in the cliffs of Kyaukpandoung, Arakan, in April and May and that it is rare elsewhere. There seem to be no Arakan specimens, however, to bear out this record, nor is it mentioned in the Fauna.]

Delichon cashmeriensis. Kashmir House Martin.

I obtained one in February 1934 at Myitkyina (*Ibis*, April 1935). On January 15th, 1936 I saw a flock on the China border near Sima (4,500 ft.) and shot one out of a flock on January 19th just north of Myitkyina. A very large flock of swallows and sand-martins seen on a sand-band on January 28th also undoubtedly contained some of these birds.

This bird on the wing looks much more like a sand-martin with a white rump than *urbica* or *nipalensis*, both of which are steely-blue in appearance on the upper parts. [I have given reasons (*J.B.N.H.S.*, xxxii, 348) for believing that *cashmeriensis* is not a race of *urbica*; it seems, however, that it may well be a race of *daoypus*.]

Circus cyaneus. Hen Harrier.

There appear to be no published records of the Hen Harrier in Burma. I have more than once seen very white Harriers in Burma

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which I assumed to be *macrourus* but never managed to obtain one until January 26th 1936, when I shot a male Hen Harrier hunting in willow scrub on the Irrawaddy just below Myitkyina. Mr. T. R. Livesey says that he has seen it on the Inle Lake and there are numerous records from Yunnan. From an examination of specimens in the British Museum it is clear that the Pale and Hen Harriers would be difficult to distinguish when on the wing. Since Oates's day (1889) the published notes on all harriers are very meagre and I can find no later records of the Pale Harrier, so that it is to be hoped that some Burma naturalist will turn his attention to them.

Rallus aquaticus indicus. Indian Water Rail.

A specimen of this bird was obtained by Mr. J. A. Edwards of the Indian Police of March 9th 1935, a few miles north of Myitkyina. I had previously flushed a number out of a marshy corner of a jheel at Chaungwa in the Indaw Valley while duck-shooting in late January 1935, but the skin of the only one shot by me went bad and had to be destroyed. This bird is described in the *Fauna* as 'migratory in winter to Burma' but the only published records of any one having met with it are below. [Blyth recorded this bird from Arakan and Captain Shopland informed Oates that he had obtained it there, doubtless near Akyab where he was stationed. It is listed by Rippon as occurring on the Inle Lake, S. Shan States.]

Charadrius placidus. Long-billed Ringed Plover.

The only previous Burma record is of one shot by me on March 27th 1933 in the N'Mai Valley. I got one out of three on February 1st 1936, near Tasang on the Irrawaddy and thought I saw another near Myitkyina about a fortnight later. But it seems a rare bird, easy to overlook on the big shingle banks of the Upper Irrawaddy.

Nyroca marila marila. Scaup.

I shot a female scaup on a jheel near Katcho on November 10th 1935. It was with an immature tufted duck and one other (unidentified) duck and the whitish patch all round the face in front of the eye was most noticeable. There are no previous Burma records, but four from Chittagong and Assam.

August 1936. J. K. STANFORD, I.C.S.

XV.—CURIOUS NESTING SITES OF 'THE LARGE PIED WAGTAIL [*MOTACILLA LUGUBRIS MADERASPATENSIS* (GMEL.)]

In *The Birds of Southern India* by Baker and Inglis, mention is made of the fact that these birds nest in all sorts of places—in holes, wells, bridges and buildings, in crevices of rocks etc.

In 1934 several nests were found and in four instances the nests were built on the bottom flanges of small girder bridges on the

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railway over which more than twenty trains passed each day. The nests observed were in each instance directly under the running rails and not more than from 2 ft. 6 in. to 4 ft. below them.

It seems curious for these birds to have selected these bridges as the chances of rearing their young seem doubtful owing to the risk of splashes of hot water, oil, hot cinders and ash falling from passing locomotives destroying them.

Details of nests found are as under :—

(1) 1 -3-34. Nest with 4 fresh eggs.
(2) 10-4-34. Two nests in the same bridge about four feet apart, one with 4 eggs and the other with 3 eggs.
(3) 20-4-34. Nest newly constructed, eggs not laid.

TANJORE. C. H. BIDDULPH.

December 30, 1936.

XVI.—THE HABITS OF VULTURES.

A note on the eyesight of vultures was published in the last issue of the *Journal* by Mr. Dunbar Brander which is of much interest, as the habits of vultures seem to have escaped the notice of ornithologists to some extent. Mr. Brander's description as to how the vultures find the carcases and offal they feed on is largely correct, but I question the accuracy of some of his remarks on their habits.

Vultures do not start their soaring as early as he suggests. They are particularly late risers, and it is only after a good deal of shaking out of their filthy plumage that they venture to put it to the test of flight. Then they start out—like most birds—in the coolness of the morning to search for food—only they are later out than most. In big-game jungle, vultures may be seen in pairs, or solitary, quartering the hill sides looking eagerly down into the jungle for a possible tiger or leopard 'kill'. They work it methodically like a harrier at the various levels. It is only when the day begins to heat up that vultures in company with other birds of prey start their soaring—which is not, I think, as Mr. Brander supposes for the purpose of finding their food but to escape the heat of the day by keeping aloft at several thousand feet elevation. Of course they are on the lookout for food too—combining pleasure with profit—but I do not think food is their primary object in soaring. This habit of soaring of birds of prey is well known and observed by falconers. Vultures that are gorged with offal will omit of course the morning search for food, and they then sit in numbers on some high tree working it off, but most of them will be seen to go soaring up later in the day—as if for pleasure. The Jodhpur desert—for example—can be very hot at ground level—even for vultures, and by going up a few thousand feet they get into cool air.

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Harriers and other birds of prey may often be seen soaring up with vultures and they are obviously not seeking their prey. They are seeking the cool air at a high altitude.

Mr. Brander describes very well how the sky is 'drained' of its vultures as soon as a carcase is found—vulture after vulture following on the direct and purposeful flight of those that give the show away—only it is not only the crow that gives the first indication. In many places crows are absent or scarce. Dogs, wolves and jackals are especially watched by vultures for this purpose and probably the big cats too.

On their own—without a pointer—vultures can be very silly and pass quite close to a carcase without spotting it. This is often to be seen when waiting in hiding for a tiger or leopard over a 'kill'. The inability of vultures to find such 'kills', points to their having little or no sense of smell.

Recently instances of vultures descending to feed on a tiger 'kill' by night have been recorded—presumably by moon light. In view of their terror of the tiger such instances are noteworthy. I have seen a tiger at noon charge out on to vultures that had the temerity to descend onto the 'kill', and leap up at them and try to claw them down—a pretty sight!

How long can vultures go without food? How often do they drink? There are a number of interesting questions to ask about these filthy fowl. The Lämmergeyer has always intrigued me for I have never seen one feeding yet!

Would Mr. Donald give us some information about the soaring of birds of prey?

TAUNGGYI, BURMA. T. R. LIVESEY.

September 30, 1936.

XVII.—EAGLES ON THE NILGIRIS.

A few years ago I was having a talk on the verandah of the Ootacamund Club with two sportsmen who were discussing their day's shoot on the downs. Their bag consisted of three or four jungle fowl, all hens, and a brace of woodcock, and they were deploring the shortage of game generally on the hills. My suggestion that the shooting of jungle fowl be restricted to cock birds only did not find favour, and when I remarked that perhaps the various eagles met with were responsible they told me there were no eagles here, and that if I meant kites or sparrow hawks, they certainly did no harm. Shortly after this I was asked by a lady if I would call round at her house to shoot a kite which was going off with her fowls and pigeons. I could understand the lady not knowing that it was not the common kite which was the culprit, but it surprised me very much that two men who were out with their guns every shooting season did not know better. When, later on, I was prompted to write an article on eagles to a certain newspaper I sent each of them a copy.

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I have recently come across this article and find, that while my descriptions of these birds are such that will make identification easy to people like myself who have not taken up natural history as a study, they will not assist the naturalist readers of your journal in the same way. I am however writing these notes on the same lines and trust they will prove of interest.

There are three eagles on these hills. The Black eagle, Bonelli's eagle, and a bird which may be the Imperial eagle.[1] The last is not often seen and, I think, is only an occasional visitor. The first one I saw was on the hill above the Toda cathedral at the top of the Sigur ghat. It was on the summit of a cliff and was feeding on what looked like a hare. I was able to approach to within about fifteen yards when it rose and flew away from me, but it went only a short distance and then came at me with talons extended, and it was all I could do to keep it off with a heavy walking stick. I gradually increased my distance away from the kill, but it was some time before I got clear and felt safe.

I mentioned the story that evening to a friend, and he arranged to come out with me to the spot next morning. We were fortunate to see two birds this time. They were at first circling above us with a dozen or more vultures, obviously all interested in some dead beast in the valley below. Presently the two eagles separated from the others and flew over us at no great height. My friend felt sure they were golden eagles and I was not any the wiser at the time, but I have since been told that they may have been the Imperial eagle and I have seen three or four others since.

The bird is dark brown and closely resembles the Golden eagle, but it has not the same easy flight of either the Golden or the Bonelli's eagle, and I can well imagine it has not the speed of the latter.

The Indian Black Eagle (*Ictinaëtus malayensis perniger*).

This is a very handsome bird. All black except for its feet which are bright yellow. I have seen it at close quarters many times, and on one occasion I saw one chivy a snipe which I had put up near the Avalanche bungalow. It hunts after the method of the harrier, beating the hill side, and at times checking its flight and dropping into tall grass. I once drew a friend's attention to one which was beating over some low scrub, and his remark that it was a kite somewhat darker than the ordinary might be made by any one who was not a keen observer. It does not look much bigger than a kite, but the span of its wings is quite five to five and a half feet, and the greenish horny bill and fierce looking eyes proclaim it as something more savage than the homely old kite.

These eagles are to be seen, either singly or in pairs, all over these hills and especially where the plateau falls away to the low

[1] [Neither the Golden Eagle nor the Imperial Eagle are known to occur on the Nilgiris. The Small Indian Spotted Eagle (*Aquila pomarina hastata*) has been obtained at Kotagiri.—Eds.]

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country. I have seen them on both the Gudalur and the Mettapalliam ghats.

BONELLI'S EAGLE (*Hieraaëtus fasciatus*).

These birds are common on the Nilgiris although I have never seen more than two at a time. I have also never seen one by itself. They hunt in pairs and put in some wonderful team work. It is surprising to know how very few people there are up here who have any knowledge about them, and it is pretty certain that many who keep poultry and pigeons think that the birds they have lost have been taken by kites or sparrow hawks, whereas the culprit is one which comes under the 'true eagle' class.

Pigeons are taken in flight while a chicken or perhaps a full grown hen is swooped on from a height and disappears before the owner is aware of what has happened. People on the Nilgiris who read this article might like to have a description of the bird, or would want to know where to look for it, and I can best describe it as having a white breast with the under-parts of the wing a browny white, and the upper parts a dark brown throughout. The wing expanse is a full six feet, and although this might be discredited when the birds are seen by themselves high up in the air, a better idea of their size is obtained if they are seen in close proximity to crows or kites. The description given will help towards identifying the bird, and I suggest that if a flock of pigeons is seen in flight over the bazaar, or any where else, a patient watch might be rewarded. Ordinarily the pigeons will be circling round together, but if it is noticed they have suddenly separated into twos and threes and commenced zig-zag and faster flighting it means they have spotted the enemy, perhaps a mile up overhead, or perhaps already on the downward swoop. The speed is terrific and the noise as they approach is just as though a huge rocket was going through the air. I have more than once seen a chase from start to finish, and although there are two eagles which do the pursuing it is usually only the one pigeon that they pursue. Sometimes the eagles hunt independently and chase two birds, but as a rule they rely on team work to make certain of getting one.

It is probable that while the eagles have been watching the pigeons from above they have been able to gauge the speed of the fliers and make their decision accordingly. A few young birds in a flock can, no doubt, be easily picked out, and perhaps the decision, to follow only one, is made if all the pigeons are mature and strong on the wing.

If it so happens that the eagles are seen before they have swooped, it will be noticed that they give the appearance of not being in the least interested. They move slowly, one behind the other, and the leader's dive is so sudden as to be almost unexpected. No. 2 waits a few moments till it knows which bird is to be chased and sometimes it makes a kill with its first swoop. If it misses, it allows itself to be taken up by the momentum of its dive, and a succession of dives may be repeated in this way. No. 1 eagle meanwhile pursues relentlessly, and whether the pigeon turns to right or left, or does a spiral dive or a quick rise, the

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eagle is just behind, and if it is not fast enough to catch up with the pigeon the other one is almost certain to get it. I don't say that all pigeons can be caught. I have seen some get away, but the fact that the average pigeon, which is a fast flier, can be caught, means that the eagle is gifted with considerable speed. The Bonelli does considerable damage among poultry and also takes toll of the small game on these hills, and I should not be surprised to know that a swoop down to the tanks in the low country supplies him with an occasional wild duck or teal.

Bonelli's eagle is to be seen on the Nilgiris at all seasons of the year and I think it must nest on the rocky crags of Mukerti or Nilgiri Peak, or perhaps on the cliffs above Masingudi. From two to three thousand feet below I have watched a pair fly out and return to a ledge on the cliff side where I feel sure there must have been a nest.

One wonders how this eagle gets its food during the monsoon when the skies are overcast for weeks and months at a time. It hunts in the open and needs good visibility to search out game, and apparently it never leaves its haunts, as I have seen a pair at work almost as soon as a blue sky has appeared after a lapse of many days. The solution must be that a flight of an hour or so would take it into bright sunshine either in a north easterly or south west direction according to the time of the year. Its hunting beat must cover a very extensive area when it is realized that if flighting a mile or so above the highest mountain tops, its range of vision can take in places so far as apart as Gudalur and Coimbatore in one direction, and Nilambur and Sathamangalam in another.

The flying man can best appreciate this but he has not the eye of an eagle. The eagle must do a good one hundred and twenty miles an hour on a downward flight so that a drop down from Dodabetta to Gudalur would not take much more than ten minutes.

It is curious how deceptive are the sizes of birds when viewed on the wing. I once pointed out two Bonelli's eagles to a man who estimated the span at three feet, which is just one half the actual size. I recollect also reading a report of an address given by a lady in Ootacamund, in which she mentioned the span of an albatross as very nearly four feet, and her audience were astonished to know that this gull was so big.

Some years ago I was travelling by steamer between Adelaide and Fremantle and dozens of these birds followed us for three or four days. Passengers were interested to know actually how big they were and the general opinion among them was that the wing span was not less than five feet, and all were surprised to learn from the ship's officers that ten feet[1] was nearer the mark. Occasionally one of these birds gets knocked out by coming into contact with the rigging and one which fell on deck was measured and taped

[1] [J. F. Green (*Ocean Birds*, p. 5) says that the largest albatross out of well over a hundred measured by him had a span of 11 ft. 4 in. from tip to tip.—Eds.]

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out at over ten feet. Bonelli's eagle, as I have said, measures six feet. A certain buzzard on these hills is very like the Bonelli. Its flight is somewhat similar and it looks to be almost as big, but it can be distinguished by its darker breast and slightly striped colouring on the lower parts of the wings. I have not seen them hunt game and they take no notice of pigeons but on many occasions I have seen them knock down a honey-comb. It is in the bright sunny days of spring that Bonelli's eagle is most frequently seen, and it is also then a common sight to see them mobbed by crows. The reason is that the eagle sometimes goes off with a young crow as he would a pigeon and in consequence is hated by the tribe.

In concluding these notes I would like to say something about falcons. The Peregrine[1] and the Lugger are both found here at certain seasons and I have had opportunities to watch them on shikar. Both are destructive to small birds, and while both no doubt are capable of taking pigeons and poultry I feel sure that of the two the lugger does most damage. He kills pigeons and jungle hens bigger than himself, and for persistence in the chase has no equal. Bonelli's eagle can be scared off his attack on pigeons by shouting and clapping of hands, but nothing frightens the lugger. I saw one chase a pigeon for a full half hour and catch it eventually. The pigeon seemed to have the speed and at times got well ahead but the lugger did not give in, and the end came so suddenly that I think the pigeon gave up in despair. It collapsed in mid air when the lugger was some yards behind and was caught before it dropped to earth. The whole chase took place in a valley between two high spurs and the finish was immediately above me. I had the satisfaction of shooting the lugger as he came to earth astride the dead pigeon.

OOTACAMUND. H. E. BURGESS.

July 1936.

XVIII.—THE DISTRIBUTION AND NIDIFICATION OF THE GREATER SPOTTED EAGLE (*AQUILA CLANGA* PALLAS) IN SIND.

Hume considered *A. clanga* to be the commonest eagle in Sind. This however was in 1872 and the scene since has changed considerably. *Clanga* is no longer as abundant now as it was 64 years ago.

The Greater Spotted Eagle is a bird of well watered and fairly well wooded tracts, where rivers, perennial canals, swamps or lakes provide it with a plentiful supply of frogs, its staple food.

[1] [The Peregrine (*F. peregrinus calidus*) and the Sahin Falcon (*F. p. peregrinator*) both occur on the Nigiris. The latter is said to be rare. The Lugger Falcon (*F. jugger*) has not been recorded from the area, though it has been obtained in the Wynaad. Unfortunately Mr. Burgess did not send us the specimen obtained by him for identification. Skins of the larger birds of prey from the South Indian Hill ranges are wanted; the Society would be glad to receive specimens.—EDS.]

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In drier tracts, it is seldom if ever met with and is replaced by the Indian Tawny Eagle (*Aquila vindhiana*), a degenerate species so far as eagles go, and the butt of that black bounder, the 'common or garden' crow.

In the United Provinces I have seen this eagle, when on the ground after offal, baited and its tail well pulled by a single pair of Jungle Crows. So much for its aquiline dignity, if it ever had any. In Sind it also stoops to eat offal and I have seen it hanging on to the fringe of a heaving mass of vultures gorging on the carcass of a camel. I have little respect for it, for an eagle it has little majesty, except perhaps when on the wing and then it cannot help itself.

It is at present the commonest eagle in Sind and is, perhaps just as well, seldom met with, where the Imperial, Bonelli's and the Greater Spotted Eagle, truly majestic birds, are found.

Before the construction of river bunds, the Indus when in spate, yearly overflowed its banks, the spill waters flooding more or less well defined tracts and leaving in their wake numerous lakes, some very extensive, which provided the habitat necessary for this eagle.

A great volume of water overflowed the left bank of the Indus and winding through the sand dunes on the eastern borders of the Sukkur district, along the Raini Nai, the Karo Naro and other well defined channels, entered the Eastern Nara and so followed the course of the Hakro, the lost river of Sind, through Khairpur State and Thar Parkar into the Dhoro Puran, which emptied itself into the Runn of Cutch, a few miles west of Rahim-ki-Bazaar.

This mighty volume of water formed numerous dhands on both banks of the main discharge channel, the Eastern Nara, throughout its length of about 276 miles and here in the 'seventies and eighties' Doig found the Greater Spotted Eagle common and believed that it bred in November and December, though he never actually found a nest.

The construction during the past 60 years of hundreds of miles of bunds and extensive canal systems has greatly changed the physical features of these old flood tracts.

Perennial lakes, extensive broads and miles of swamps where wild fowl, snipe and other waders collected in thousands, providing sport, which is now but a recollection, have ceased to exist. The Samaro dhand where Doig found the Large Cormorant (*P. carbo*) breeding in hundreds is now as dry as a bone and the great Makhi dhand, an area of about 20 square miles, in Sanghar taluka, where Bachu 'Badshah' and Piru 'Wazir' two notorious Hur outlaws had their stronghold in 1894, is now just a vast depression, practically the whole of which is under cultivation.

The total extinction of so many large lakes and swamps is undoubtedly the cause of *clanga* not being as abundant now as it was in the days of Hume and Doig.

The scene, however, may again change and perhaps, as far as *clanga* is concerned for the better. The existence now, owing to the Sukkur Barrage, of numerous, great perennial canals must affect in time the fauna of Sind, and perhaps in years to come, when the

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thousands of trees planted along the banks of the Barrage Canals reach maturity, the Greater Spotted Eagle, a fine bird, will once again come into its own and be as common as it was 64 years ago.

It is still to be met with throughout Sind in riverain and other suitable tracts. I have found it in such localities in every district in Sind, but it is nevertheless, far from common.

On the 1st March 1931 I was walking along the banks of the Mahie canal, near Mir Kosh, about 6 miles from the Indus, in Sukkur district, when I spotted an eagle's nest on a large babul tree. I could see that a bird was seated in the nest. While still about 100 yards away, another eagle was seen making a bee-line for the tree on which the nest was situated. The approaching bird swooped gracefully down and glided over the nest, so low that the bird seated in the nest was able to take easily, what later proved to be a large bull frog, from the talons of the bird in flight, which almost immediately and without apparent effort picked up elevation and speed by a few rapid beats of its powerful wings. It circled round majestically and perched on a large tree about 200 yards from the nest, apparently well satisfied with what it had accomplished. Meanwhile the bird in the nest appeared to be pecking at what had been brought by its mate. On my approach to about 50 yards of the nest it stopped pecking and turned its head in my direction, watching me closely. On my approach still nearer, it stood up in the nest and on clapping my hands flew off, enabling me to identify it with certainty as a female Greater Spotted Eagle.

The male, which remained perched, permitted me to approach within about 40 yards. He was a smaller bird than his mate and from his rich colouring a young adult. While the nest was being taken both birds circled round but made no attempt to attack the climber.

The nest which was placed about 25 feet high, was a fairly large structure of sticks, mostly 'babul' and 'kandi' lined sparingly with dried 'sar' grass and a few stems of 'pan' and 'deer'. It contained a single egg, perfectly fresh, and I believe the first of this Eagle taken in Sind.

The egg was typical of the species, a broad, blunted oval, richly splashed and blotched with pale purple and reddish brown. A very handsome egg and a prize worth securing.

The remains of a Purple Coot, a mud fish, frogs and a Ring Dove were found in the nest and on the ground below.

The nest which was firmly put together was about 30 inches in diameter and 4 inches in depth interiorly.

It was larger than the average nest of the Tawny Eagle. I visited the place about a month later but found no trace of the birds. In December 1933 I came across a pair near Bogar dhand about 5 miles further west, but failed to locate their nest. It is doubtful if they had one, as it was rather too early in the season for them to be breeding.

KARACHI. K. R. EATES.

September 4, 1936. F.Z.S., M.B.O.U.

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XIX.—NUMBER OF EGGS LAID BY THE INDIAN SHIKRA [*ASTUR BADIUS DUSSUMIERI* (TEMM. AND LANG.)].

In March 1934 a pair of these birds were frequently seen in my compound and by watching their movements the nest was found on a banyan tree.

When the bird was observed to be sitting three eggs, fresh, were taken on 11-3-34. The birds remained in the vicinity and on 23-3-34 another fresh egg was taken from the same nest. It was thought that this would have ended the female's egg-laying for the season, but on seeing her sitting again on 4-4-34 a further three fresh eggs were obtained. It will thus be seen that this Shikra laid seven eggs within a month against a normal clutch of from three to four eggs.

The average measurement of the eggs was 1.45″ × 1.17″, which shows them to be slightly smaller than the measurements given by Baker and Inglis in *The Birds of Southern India.*

The birds remained in the vicinity until the end of May 1934 but did not lay again.

The same pair it is presumed built again in the compound in 1935 and 1936; the nest in 1935 being on a different tree. In 1936 the same tree as was used in 1934 was selected, the nest being constructed on a different part of the tree.

Although it is September when this note is being written the birds are still seen flying around and cause the smaller birds many anxious moments.

TANJORE. C. H. BIDDULPH.

December 30, 1936.

XX.—THE STATUS OF THE KOEL [*EUDYNAMIS SCOLOPACEUS* (L.)] IN SIND.

(*With a map.*)

The status of the Koel in Sind is peculiar. How, and from whence it originally came and established itself in Karachi, situated as it is between desert and sea, has long been a mystery.

It is common and resident in Cutch but between Cutch and Karachi lie some most inhospitable and arid desert tracts, devoid, except where the hand of Man is evident, of all vegetation necessary for the existence of the species, which is arboreal, mainly fruit-eating and as habitat must have large leafed, shady, trees, groves and fruit gardens. The Crow, another factor necessary to its survival is of course as ubiquitous in Sind as elsewhere in India.

The occurrence of a species in any tract of country is accounted for either by natural extension of range or by introduction.

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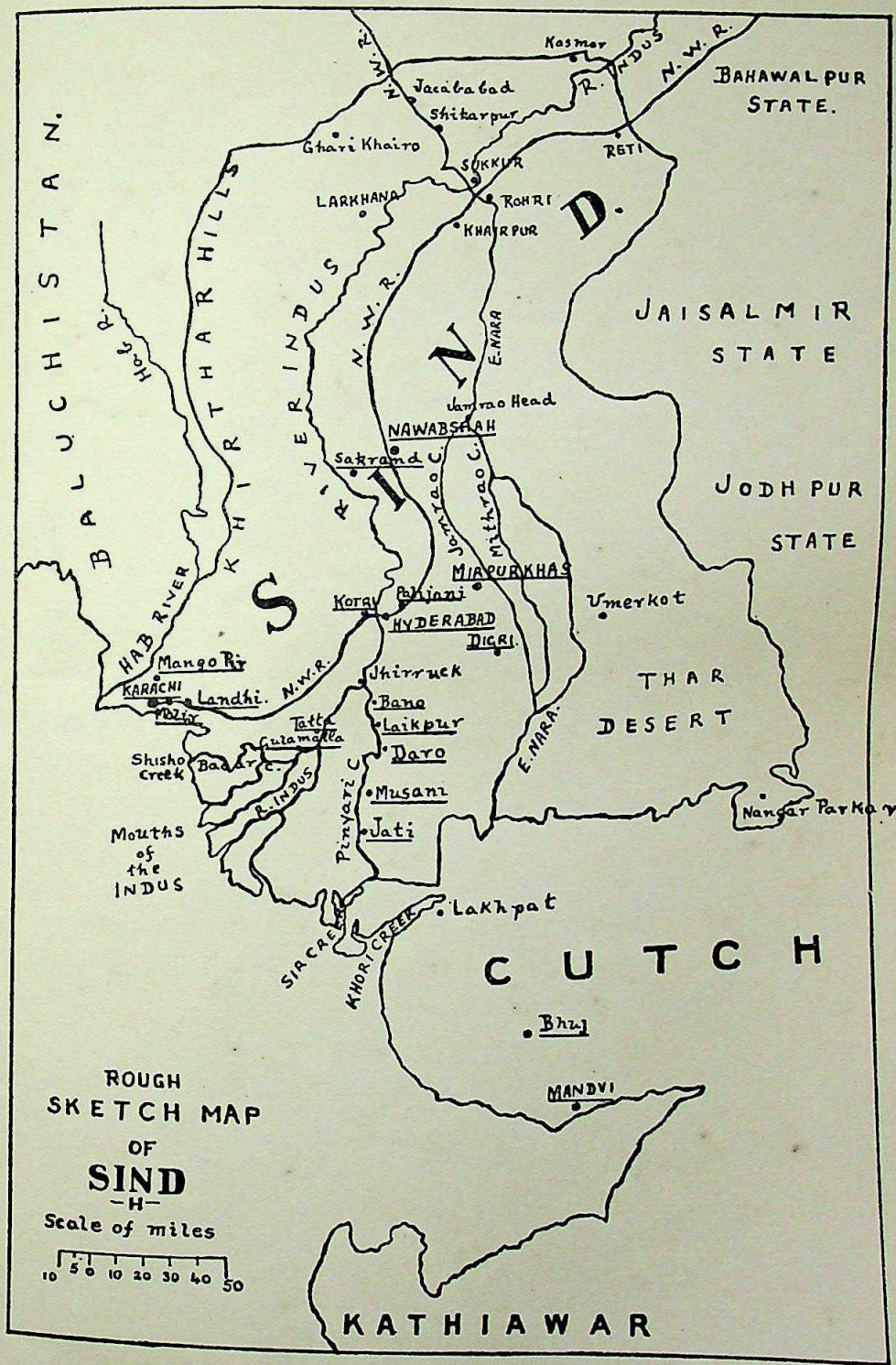

The Distribution of the Koel [*E. scolopaceus* (L.)] in Sind.

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C. B. Ticehurst who energetically worked Sind during the latter years of the Great War remarks, 'its arrival around Karachi whether by natural extension of range or by introduction is uncertain, though the latter seems more likely, as it is still absent from other suitable towns further east.'

He, not unnaturally, arrives at this conclusion because of the fact that the Koel then, had a very restricted range in Sind, and was more or less localised in Karachi and its environs with Malir, about 12 miles distant, as its limit of extension into the hinterland.

Opportunely I was posted to Sind in February 1920 and was thereby enabled to take up observations very soon after Ticehurst left Karachi.

S. A. Strip, a keen naturalist and an accurate observer, tells me that he is perfectly sure that the Koel was not in Karachi in 1875, but that on his return from Kathiawar in 1887 he found it present and to all accounts a permanent resident; E. A. Butler 1879, catalogues the species as a permanent resident in Cutch and Kathiawar, and tolerably common, except in Sind, where it is scarce; Murray 1884, also says that it is common in Cutch and Kathiawar but rare in Sind, where it occurs only during the rains.

In 1885, H. E. Barnes writing on the Birds of the Bombay Presidency says, 'The Indian Koel is very common throughout the district excepting Sind, where it appears to be somewhat rare'.

Later, in 1895, Blanford writing on its distribution in the *Fauna of India* says, 'Rare in Sind and the Punjab and is not known further west. To the eastward it ranges to China.'

E. H. Aitken (EHA), writing in 1907 on the birds of Karachi, lists the species, among others, as a familiar garden bird.

Dr. C. B. Ticehurst, who worked Sind from October 1917 to January 1920, writes in *The Birds of Sind,* 'Ibis', 1922-4:—

'Contrary to general statements of the inhabitants of Karachi, the Koel is resident there and not a hot-weather visitor; its lack of noisiness in winter causes it to escape casual observation.

'The Koel has a very unique distribution in Sind; so far as I am aware it only occurs at Karachi and the neighbourhood, Malir etc. Mr. Gordon informs me that it certainly does not occur in Jacobabad or at Mirpurkhas, nor have I seen it at any of the many places I have visited in Central Sind.

'Doig never met with it in the Eastern Nara, nor Barnes at Hyderabad; Butler writing in 1878, says that it is decidedly rare, and he only saw it once and that was at Hyderabad in June; Butler who was certainly in Karachi for a part of the hot weatner of 1877 and 1878, evidently did not meet with it then, and had it been as common there then as it is now, one could not be a day in the Cantonment without hearing it at that season. On the other hand, Hume (1872) stated that it was very seldom seen during his cold weather visit, but Malden informed him he had more than once killed it at Jacobabad. It is fairly common at Mandvi in Cutch.

'It would seem, therefore, that the Koel is a fairly recent

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arrival around Karachi (it was there in 1907), whether by natural extension of range or by introduction is uncertain, though the latter seems more likely, as it is still absent from other suitable towns farther east.

'It is now excessively common both in the Cantonment and in the Lyari Gardens; it begins calling at the end of the third week in February, and its incessant and monotonous voice can be heard from then to well on into September, occasionally in October or even early November, after which date it becomes inconspicuous and retiring.'

E. C. Stuart-Baker, *Fauna of India*, 1927, writing on its distribution says that it is rare in Sind and the Punjab while Hugh Whistler, 1935, says that in Sind it is only locally common; lastly I think it very necessary to mention that Douglas Dewar writing in the *Journal of the Bombay Natural History Society* 1908, on the migration of certain species, says, 'There is not the least doubt that it is merely a summer migrant to Lahore.

'Not a Koel is to be seen in that place between the end of October and the middle of March, but throughout the hot weather it is exceedingly abundant.'

The foregoing is a summary of the information I have been able to collect on the distribution of the Koel in Sind prior to 1920, on observations made by ornithologists such as Hume, Scrope, Doig, Butler, Barnes, E. H. Aitken, Frank Ludlow and Dr. C. B. Ticehurst.

My own observations in Sind now cover an unbroken period of 16 years and include the whole of the Province with the exception of the Khirthar mountains and the southern and eastern portions of the great Thar desert, regions to which the Koel is never likely to venture, even as a straggler.

On demobilisation in February 1920, I was posted to Karachi and during the course of a couple of years found the species common, a permanent resident and breeding freely in Karachi, Malir and Landhi.

Between 1920 and 1928 I took many crow's nests, some containing as many as six eggs of the Koel, and sent Stuart-Baker a series including the eggs of the foster parents in all cases the Sind House Crow.

Up to the winter of 1928 the Koel certainly did not extend, as a permanent resident, beyond Landhi, about 15 miles distant, eastward of Karachi and northward beyond the trans-Lyari Sewage Farm, as I failed to locate it at Mangho Pir and also never found its eggs there, though I examined several years in succession, numerous crow's nests around Mangho Pir and at Dharmao further north, where numbers of house crows breed regularly.

On my return to Karachi in 1936, I discovered that it had found its way north to Mangho Pir, where it had permanently established itself.

I did not meet with it at Kotri, Hyderabad or Badin in the summer of 1922, nor again in Hyderabad in March 1929, or further north at Matiari, Sekhat, Khebar, Hala or Saidabad in March and April the same year, but in June 1934, from the 16th to the 30th,

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I found it common and breeding at Kotri, Hyderabad and Palijani, about 18 miles north of Hyderabad.

I was stationed in Sukkur from the 10th January 1930 to the 4th February 1934, and failed to find it anywhere in the district, though there is suitable habitat at Sukkur, Rohri, Pano Akil, Ghotki, Chak, Shikarpur and many other places.

On the 1st June 1933 I thought I heard a bird call once, in the mango and date gardens on the Rohri banks of the Indus. I failed, however, to locate it and after again visiting the spot the following day and going through about 3 miles of mango and date groves, in the broiling heat of a June sun, without hearing or seeing a bird, I was convinced that I had mistaken the shrill *ko-ee* of small boys, who were about the gardens keeping off crows, minas and babblers, for the familiar *ko-e-o* of this bird. As crows were nesting in some numbers in the mango and date groves, any koels in the locality would assuredly have made known their presence during the course of the afternoon and evening I spent there.

In Bahawalpur State, which borders Sukkur district on the north, not a bird was seen or heard during a three-days' visit to Bahawalpur in late March 1933.

Similarly in Khairpur State, south of Sukkur I failed to meet with it anywhere, though most suitable localities exist, during the course of frequent hot weather visits to the State in 1930 and three succeeding years.

At Larkhana, on the southern border of the Upper Sind Frontier district, I failed to come across it, during short visits in July 1933 and August 1934. Young crows though everywhere much in evidence, the majority just able to fly and still being fed by the parent birds, koels, either adult or young were conspicuous by their absence and were nowhere to be found.

Malden informed Hume in 1872 that he had more than once killed it at Jacobabad, in the Upper Sind Frontier district, but this I feel sure is a case of mistaken identity, to use police parlance, and that the birds killed by Malden were in reality Pied-crested Cuckoos, which are common in Jacobabad during the hot weather. On the other hand Gordon, now Chief Engineer in Sind, informed Ticehurst that it did not occur in Jacobabad.

To the correctness of this I can fully testify, as I was stationed at Jacobabad from July to middle November, 1934 and found it totally absent, not only in Jacobabad itself, which is well wooded, but throughout the length and breadth of this district. During many wanderings beween Ghari Khairo and Kashmor and in suitable localities along the Desert and Begari canals, during July, August and September though I came across numbers of young crows still under parental care and in July found some birds still on eggs or rearing callow young I failed to find any trace whatever of the Koel. If, as Malden said, the bird was found in Jacobabad more than once then, there is no apparent reason why it should not still be found, not only in Jacobabad but in the adjoining districts of Sukkur and Larkhana also, where there is suitable habitat and fruit trees aplenty, in the way of mango, pipal, bar, date,

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guava, fig, papia and mulberry, all suitable to the palate of the Koel.

In Mirpurkhas, Thar Parkar district, I failed to find it during the summer of 1922, but on my return there in January 1936, I found it abundant and extending south as far as Digri, 38 miles distant. In January, February and March the same year I did not succeed in coming across it further eastward and failed to locate it at either Samaro or Umarkot, the city of the desert, on the edge of the wonderfully fertile Nara valley, where there is suitable environment almost everywhere and much in the way of Koeline fruits.

At Mirpurkhas and Digri I found it common and frequently saw both sexes feeding on pipal and bar (banyan) berries in company with bulbuls, mynahs, tree-pies and crows. In the former place I both heard and saw birds daily, when in headquarters between the 4th January and the 23rd March and am authoritatively informed that it is now a resident species and breeds, laying its eggs as usual in the nests of crows.

In Nawabshah the headquarters of the district, I found it common and quite noisy on my arrival there in April 1935 and daily, as is its wont, it became more, and more noisy and irksome as the heat increased and the breeding season of the crows approached.

The species in Nawabshah itself is a permanent resident and breeds in June and July.

The presence of bar, pipal and nim trees in the official residential area and mangoes, guavas, figs, and grapes in most gardens, which provide food and leafy shelter for the birds all the year round, is undoubtedly the cause of it now being a regular resident. It certainly extends, as a straggler at all events, as far south-west as Sakrand, 12 miles distant, where I met with a young male, fully fledged and well able to fly, on the 9th October 1935, though I failed to find it on the 6th April 1929 when I was at Sakrand for a day and again in May, June, July, November and December, 1935.

I did not succeed in locating the bird further north in Nawabshah district during the summer of 1935, though there is most suitable habitat and much summer fruit available around Abji, Mithiani, Darbelo and Tharushah, where mangoes, figs, dates, pipal, bar and oranges grow in abundance, in extensive gardens and groves on the banks of the Nai Lakho canal and where crows of course, a very necessary factor, are common and breed in great numbers.

From April to the end of December 1935, excepting the one occasion in October when I came across a lone bird in Sakrand, I failed to find it anywhere outside of Nawabshah itself and am confident that at present, the species, as a permanent resident, is restricted to the limits of the residential area in the immediate viciniy of Nawabshah.

In Karachi district in 1934 I was not surprised to find it at suitable places along the Pinyari canal, which takes off from the left bank of the Indus below Jhirruck and enters the Sir creek

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below Jati, also called Mughal Bin, after flowing a southerly course of about 73 miles through the talukas of Mirpur Bathoro, Sujawal and Jati. It has 33 branches totalling 240 miles in length and over 3,000 distributaries, and practically irrigates the whole of Mirpur Bathoro and Jati, and a part of the Sujawal taluka.

At Mughal Bin the Gadap and Sher Khan *wahs* take off and flow in a south-easterly direction, while the Hajia and Saida *wahs* take off and flow roughly south-west. The Sher Khan *wah*, which flows towards Cutch and tails off into a branch of the Sir creek, has a total length, from its head at Jati, of about 40 miles.

In late March and April 1934 I more or less followed the course of the Pinyari canal from Bano, 2 miles below its take off from the Indus, to Jati, below which it enters the Sir creek, the middle and lower reaches of which divide Cutch from Sind, and found the Koel in gardens and groves at Bano, Laikpur, Daro, Musani and Mughal Bin. At Daro an old Cutchi mali, who had been there some years told me that the bird was well known and common in Cutch and that he had seen it at Daro, during the hot weather only, for several years in succession.

They arrived, he said in March or April and left in September.

Crossing the Indus at Sujawal in April the same year I found the bird fairly common and quite noisy at Tatta, and in March 1935, the year following, I met with it at Ghulamalla, on the bank of the Baghar canal, which in 1817 was the main channel of the Indus to the sea.

It takes off from the right bank of the Indus a few miles below Tatta and enters the Shisha creek after flowing a circuitous course in a generally westerly direction of about 90 miles. The village of Ghulamalla, where there is suitable habitat, is about 12 miles south-west, as the crow flies, of Tatta. Here again the mali, an old Purbia from the United Provinces, where the bird is common and only too well known, informed me that koels came there every hot weather and remained in the gardens till after the rains.

I left Tatta on the 15th April 1934 and at Jhirruck 42 miles up-stream failed to meet with it between the 15th and 17th, though conditions were suitable in the way of mango groves and fruit gardens growing guava, mulberry, fig and pipal.

Further south and south-west at Sujawal and Mirpur Sakro, where conditions are not so favourable I failed to meet with it in May and June 1934. At Malir, a distance of about 50 miles as the crow flies from Tatta, in February 1935, it was common, and seen and heard daily from the 12th to the 20th. Similarly in Karachi it was seen and frequently heard, early mornings, in December 1934 and January and February 1935.

As the hot weather approaches it becomes more and more noisy, and now in June (1936), birds are everywhere splitting the air, each trying to out-shriek the other, with their incessant cries of '*who-are-you*'.

Lastly in May 1936, I paid several visits to Mangho Pir, 10 miles directly north of Karachi where I failed to find it from 1923

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to 1928, and both heard and saw the bird frequently. In late June the same year I found several crows' nests containing eggs of the koel in the gardens on the Gadap side of the hot springs, where dates, mangoes, guavas and papias are grown, and a local Mekrani informed me that the bird had been resident there for the past 3 or 4 years.

The continued observations of Dr. Ticehurst and myself extending over a period of about 20 years, have resulted in the collection of most interesting data regarding the status and distribution of the Koel in Sind.

It is evident that in 1920 the species was only locally common and occurred as a permanent resident only at Karachi and eastward as far as Landhi, about 15 miles distant.

Elsewhere, it was met, if at all, as a rare straggler and then not beyond the northern and eastern boundaries of Hyderabad district.

It is now, 16 years later, common and resident as far north as Nawabshah and north-east as far as Mirpurkhas. It naturally cannot extend south and due west of Karachi, nor will it ever extend north-west into Baluchistan.

My discoveries have convinced me that its presence in Karachi cannot be accounted for by introduction as firstly, the species, contrary to popular practice in the United Provinces, is never caged and secondly, for it to be commonly caged it must necessarily occur as a permanent resident elsewhere in Sind and this, as established by this paper, is definitely not the case, the hypothesis therefore that its occurrence in Karachi is due to introduction must fall through.

The only other theory which can be put forward is the natural extension of its range and this I believe to be the real reason for its occurrence in and around Karachi, where for years it has been localised as already mentioned.

Now the point left for decision is whether it originally came to Karachi from the Punjab or from Cutch.

We have it from a reliable observer like Douglas Dewar that the bird up to 1908 was merely a summer migrant to Lahore. Similarly H. Whistler writing in the 'Ibis' on the birds of the Jhelum district (1916) and the Rawal Pindi District (1920) records it as a hot-weather visitor from April to October. It is thus clear that the bird is a summer migrant to the Punjab.

If we contend that it came to us from the Punjab, we must admit that the only route by which it can reach Karachi is by following the course of the Indus as far as Hyderabad or Tatta.

If it did this originally, there is no earthly reason why some birds at least should not continue to do so now, particularly during the hot weather, and any birds taking this route, like the Pied Crested Cuckoo, must necessarily pass through Upper Sind and follow the course, down-stream, of the Indus through Khairpur State and the districts of Larkhana, Nawabshah and Hyderabad, yet during my long stay of four years in Sukkur District and subsequent visits to Bahawalpur, Upper and Central Sind, I found

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it everywhere totally absent, in spite of being continually on the *qui vive* for it, and did not fall in with it as far north as Hyderabad till 1934, though apparently it had established itself there a few years previously and had obviously migrated there from Karachi District, and extended from there north as far as Nawabshah, and east as far as Mirpurkhas, which so far as I am aware is at present the limit of its extension north-east, though it will in all probability extend in time to the Nara valley and the tracts drained by the Jamrao and Mithrao canals where there is suitable habitat.

Since I failed to meet with the species anywhere north of Nawabshah during the course of six consecutive summers, in spite of the long existence in this tract of many suitable localities where the species could easily have survived I have no hesitation in recording that the Koel has not entered Sind from the Punjab.

Let us now consider the alternative route from Cutch which is separated from Sind by the Sir creek south of Jati.

As previously stated I found the bird in March and April 1934, on the left bank of the Indus, in Karachi district, along the Pinyari canal, from Jati to Bano and along the banks of this canal and in the tracts drained by it are to be found numerous mango groves, and in most large villages pipal and bar trees and gardens growing mango, guava, papia and fals and in some places date and mulberry, which provide the Koel with food and the environment necessary for its existence on passage as a migrant. Similarly on the right bank of the Indus at places where there is suitable habitat I found it, at Tatta and Ghulamalla.

Now the only intervening tracts on this route presenting any kind of difficulty in respect of habitat, lie between the limit of its extension north-west of Cutch Mandvi and Jati and between Tatta and Landhi. The distance, as the crow flies, from Cutch Mandvi to Jati is about 130 miles, while that from Tatta to Landhi is only about 45 miles.

These intervening spaces admittedly embrace in one case a saline desert, with the barest scrub and coarse grasses the only vegetation and in the other, a waterless waste, except in the rains, of sand and desert scrub with no groves of leafy trees, yet the distances in both cases are not so great as to prevent the Koel, a strong flier, from crossing these inhospitable broken links in the chain in a few hours. The presence of the bird in the hot weather along the Pinyari canal on one hand, and its total absence on the other, north of Nawabshah, is I think sufficient proof that it does cross these broken links in the chain of suitable habitat between Cutch and Karachi and arrives in Sind from Cutch.

I believe that roughly its route of migration into Sind is from Cutch to Jati, from whence it follows the course of the Pinyari canal to Daro and Bano, about where it crosses the Indus to Tatta and thence to Landhi, Malir and Karachi.

Thus I think that the mystery of the occurrence in Karachi of the Koel has at last been solved and its extension over Sind from south to north, which is undoubtedly taking place, should

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during the course of the next decade prove of great ornithological interest.

KARACHI,
July 2, 1936.

K. R. EATES,
F.Z.S., M.B.O.U.

XXI.—THE DISTRIBUTION AND NIDIFICATION OF THE LARGE INDIAN PAROQUET (*PSITTACULA EUPATRIA NEPALENSIS* [HODGS.]) IN SIND.

Alexander the Great after conquering the Punjab in 326 B.C. sailed down the Indus into Sind, where he made extensive explorations.

On his return to Europe he took back specimens of this Paroquet, which was incidentally named after him by, I think, Linnæus. It is not definitely known however, whether the birds taken to Europe were from Sind or the Punjab. Jerdon records that, doubtless it was taken from the Punjab, where it is common, while EHA commenting in the *Sind Gazetteer* on the subsequent change of its specific name from *alexandri* to *nepalensis* writes that, it is now named *nepalensis* in contempt of Alexander the Great, who took the species back with him from Sind. As I was neither in Sind nor the Punjab in 326-325 B.C. I prefer to keep out of the controversy, though I must say that from my knowledge of its present distribution in Sind, I think that Jerdon is nearer the probable.

Nepalensis is fairly common in and around Karachi where it is resident and breeds in chimney stacks, roof eaves and suitable trees preferably, the cocoanut palm.

Stuart Baker records that Bulkly obtained its eggs near Karachi in 1881. The majority of birds kept in captivity however are not locally obtained but are brought down from the Punjab as fledglings and hawked for sale in the streets of all large towns at anything from 8 annas to 2 rupees a bird. It is of course common in the Punjab and I have frequently come across it near Kot Sabzal, in Bhawalpur State (Punjab) about 3 miles from the Sind border.

Ticehurst writing in the *Ibis* 1923, considers that Karachi birds are the descendants of escapes, as there were no certain records of it down to 1886 and because it had not been found outside of Karachi.

As this paroquet is a favourite cage bird in Karachi it *is* likely that some of the Karachi birds are the descendants of escapes, but not all, as Ticheurst was not aware that it was abundant, though very local, in parts of Upper Sind, whence it has probably found its way south to Karachi.

In Sukkur district, where I was four years, there is more or less a regular, north to south, cold weather migration from about November, the birds moving as far down as Kandhra, 8 miles

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below Rohri and about 70 miles from Ubauro, on the northern boundary of Sind, where it is resident and abundant.

Birds in couples and small flocks, apparently strays from this movement, have been met with as far south as Nawabshah, whence they doubtless find their way to Karachi, as when in couples or small flocks away from their strongholds in the north of Sind, they are relentlessly pursued and kept on the move by their smaller cousins, the Rose-ringed Paroquet (*Palæornis torquata*) which swarms throughout the Province.

It is therefore not unlikely that the colony in Karachi is added to frequently by strays which find their way south from Nawabshah, a distance of about 125 miles as the crow flies.

I do not think that the birds met with in Nawabshah district could have been from Karachi as I have not met with this Paroquet anywhere in the intervening district of Hyderabad or beyond Landhi, 15 miles east of Karachi, though there is suitable habitat, both east and west of the Indus in Karachi district from Jhirruck to Ghorabari.

I first came across it on the 10th May 1930 at Ubauro, in the north of Sukkur district about 8 miles from the Punjab border. The birds were very plentiful and I noticed numbers of young flying about with adult birds. In June the same year I was again at Ubauro and the birds were just as plentiful.

In November I found them fairly common at Mirpur Mathelo about 15 miles south west of Ubauro and in December a few birds were seen around Ghotki about 14 miles south of Mirpur Mathelo. On the 11th December 1930 I again had to visit Ubauro and found many birds paired off and courting.

Two nests were located on the 12th December, both in simal (silk-cotton) trees. In one the female was seated inside the entrance with her head out. The nest contained a few feathers. In the other the male was inside the nest. Both nests were apparently ready for eggs. Want of time prevented me from searching for other nests on this occasion, but on my again visiting the place on the 21st January 1931, I was able to continue my observations for several days without interruption.

The town of Ubauro situated 9 miles north west of Daharki, the nearest Railway Station on the main line to Lahore, dates back to about A.D. 987. Sometime later it was fortified and surrounded by a moat, the north and south entrances to the town being crossed by substantial brick bridges, which still exist, though some of the spans are crumbling and numberless bricks from the main structures have been taken away and used by the townsfolk for building purposes. These moat bridges are now the homes of spotted owlets, house sparrows, pigeons and some rose-ringed paroquets.

On the outskirts and in the town itself are many great siris, pipal, lai and talli trees which provide ideal nesting places for the Large Indian Paroquet. Outside the town are several very old gardens growing bhan (white poplar), simal, pipal, siris, mango and date trees, where also this paroquet is provided with suitable nesting sites.

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The roads approaching the town are lined with siris, lai, babul and khandi trees, but these, as nesting places are appropriated mainly by the smaller species, which seldom ventures to breed in the preserves of its larger and stronger relative.

On the 21st January 1931 I examined 14 nests. All except two contained young, mostly callow. One nest held 3 young and an egg on hatching point and the other, two young and an addled egg. The day following 17 nests were examined. All with the exception of one, in which there were two fresh eggs, contained young. On the 23rd a further 5 nests were examined and all contained young except one, which had 4 well incubated eggs.

In February I was again able to visit the locality and found, from the 10th to the 14th, six more nests all of which, strange to say, contained eggs, apparently a late laying.

On the 15th I visited Khumbra, a fairly large village on the Dahar canal about 12 miles north of Ubauro, a few miles from the Punjab border and there found this paroquet breeding in fair numbers on siris, pipal and talli trees in and around the village. I examined about half a dozen nests, all of which contained either young or well incubated eggs.

On the 23rd February I paid a flying visit to the Ubauro colony and found numbers of young birds well able to fly. The day following I was at Mirpur Mathelo about 15 miles south west of Ubauro and met with about a dozen adult birds during the few hours I was there. The year following, when at Mirpur Mathelo from the 10th to the 16th December, I found a few birds breeding in pipal and siris trees around the environs of the town. At Ubauro, where I encamped from the 18th to the 23rd of the same month, breeding was in full swing.

On the 26th June 1932 I came across a single adult male at Mirpur Mathelo and between the 19th and 23rd July, met with it for the first time at Pano Akil about 28 miles further south, where I daily saw about a score of birds.

From the 9th to the 13th November 1932, I daily came across this paroquet in small flocks at Kandhra, 9 miles south of Rohri, on the borders of Khairpur State and on the 14th of the same month found several pairs preparing to breed in holes in siris, lai and bhan trees on the Ghotki-Adilpur road, about 28 miles south of Ubauro, the stronghold of this species in Sind.

When I was posted to Karachi in 1920 this paroquet though locally common had not apparently extended east to Malir, where it has since established itself. I was encamped at Malir from the 12th to the 20th February 1935 and daily saw several birds in the fruit gardens, where it was always to be found in cocoanut groves.

On the 27th October 1935 I came across a single pair of birds in a mango tope on the banks of the Nai Lakho canal at Tharushah, Nawabshah district. The birds were being given a rough passage by the smaller species, which swarmed everywhere and gave them very little peace. They remained in the locality several days and then disappeared. Although I had paid Tharushah several visits previously and had thoroughly explored the numerous and extensive fruit gardens in the locality I had never before come across this

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paroquet, whose distinctive call, which it oft repeats both on the wing and when perched, cannot be mistaken.

Exactly two months later on the 27th December 1935, a small flock of about five birds visited Nawabshah and were given a very rough reception by the smaller species, which swarmed in hundreds and literally mobbed the minority, singled out individuals and chased them from tree to tree. The day following not a bird was to be seen. Whether they continued south and reached Karachi about 125 miles distant or returned north to again meet with persecution till they arrived within their own domains in the extreme north of Sukkur district, is a matter of conjecture.

In Sind it is an early breeder and commences to lay quite two months ahead of the smaller species. In several instances two and even three nests were found in the same tree. In many cases birds used old holes but quite a few had been freshly cut out by the birds themselves. Nests were placed from 12 to 40 feet high and some contained a few feathers besides the usual small chips of wood. The full clutch of eggs laid is four and the period of incubation about 16 days.

The courting antics of this paroquet are quite as grotesque and amusing as those of its smaller relative, the Rose-ringed Paroquet and to watch a wooing would, I think, even interest a cockney of my acquaintance, whose sum knowledge of birds was, that they, 'was fings wiv fevvers, some yer can heat and some yer carnt'.

In Karachi a favourite food of this paroquet is the dried seed of the casuarina, while in Upper Sind it is partial to the seed and tender shoots of the white poplar, lasora and nim berries, and the beans of the siris and talli.

I have occasionally seen it feeding on the ground in small flocks on dried nim berries during November and December. Unlike its smaller relative it is, in Sind at any rate, not destructive to standing crops.

The smaller species plays havoc with standing wheat, juar and bajri wherever it occurs and I have frequently seen it in scores on wayside railway platforms feeding on bagged wheat, much of which is wantonly wasted as the bags are bitten through and the grain strewn all over the place. What is not appropriated by the railway menial staff is devoured by pigeons, doves, mynahs and squirrels.

In Sukkur district *nepalensis* is known as *Takru*, literally meaning 'of the hills'.

Residents of Ubauro and Khumbra and Seraikis of the border informed me that this bird had been resident there for generations and that it had been known as *'Takru'* from time immemorial. They believe that it originally came from the hills. What hills, they cannot say. This of course is merely conjecture, as there are no hills in Sind where this paroquet could be resident. The species has obviously extended to Sind from the Punjab, where it is abundant.

At present it is only resident in the extreme north and south of the Province, in Sukkur district and around Karachi. I have

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met with it nowhere else, except as a straggler and then only in Nawabshah district.

The Rose-ringed Paroquet, except in the desert and Kohistan tracts, is extremely common everywhere and since there is suitable habitat and much in the way of parrot food in districts where *nepalensis* is at present absent, it is not unlikely that the existence now of great perennial canals, both east and west of the Indus, will in time result in the extension of its range to that of *torquata*, which has at present, more or less the monopoly of the Province.

KARACHI,
October 2, 1936.

K. R. EATES,
F.Z.S., M.B.O.U.

XXII.—THE CEYLON HOOPOE (*UPUPA EPOPS CEYLONENSIS* REICHB.).

Mr. Salim Ali in the fourth part of his admirable Ornithology of Travancore and Cochin in the *Journal* of 1st December appears to be in some doubt as to the local movements in the hills of the Ceylon Hoopoe.

While not actually in the territory of the survey, the area of the Anamallai Hills under tea, coffee and other cultivation is near enough to be typical of the area covered at about 3,500 ft. elevation and in the evergreen biotope. After a period of seven years' study of the Avi-fauna of the district a few observations of the movements of this bird may be of interest.

To start with the South West Monsoon period of from the latter end of May to the end of August and sometimes well on into September, the bird is not found, though if September be unusually fine, towards its latter end a pair or two may be seen—I saw a pair this last September on the 24th, but they usually go down to drier climes on the outbreak of the N. E. Monsoon in October, and stay till it is over returning in ones and twos sometimes as early as December, though usually about the middle of January. I saw a single bird on the 9th of this month. During February, March and April they become increasingly numerous and may be seen in pairs on any road and heard calling the familiar 'hoop-po-po' mostly during the hottest part of the day. Adults and young fully fledged may be seen at the beginning of May but all disappear with amazing suddenness at the first showers, forerunners of the approaching monsoon.

NADUAR ESTATE,
VALPARAI P.O.,

R. N. CHAMPION-JONES.

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XXIII.—NOTE ON THE SANDPIPERS IN THE PATNA DISTRICT, BEHAR, RECORDING THE OCCURRENCE OF THE AVOCET SANDPIPER, THE CURLEW STINT AND THE BROAD-BILLED STINT FROM INLAND LOCALITIES.

The following is a list of the Sandpipers taken by me in the Patna District recently, whilst investigating the birds of this place. It may prove of interest as some sea-shore and estuarine forms are recorded far inland. The date in brackets indicates the earliest date on which the birds were seen:

Numenius arquata orientalis, Brehm. The Eastern Curlew. (7th September).

Numenius phaeopus, Linn. The Whimbrel. (7th September).

Limosa l. limosa, Linn. The Black-tailed Godwit. (10th August).

Limosa l. melanuroides, Gould. The Eastern Black-tailed Godwit. (7th October).

Limosa l. lapponica, Linn. The Bar-tailed Godwit.

The above birds are met with on the Ganges as well as on inland jheels.

Terekia cinereus, Gulden. The Avocet Sandpiper. (11th September).

A specimen was obtained from a local bird-catcher on 11-9-36 and another seen with the same man on 10-10-36.

Tringa ochropus, Linn. The Green Sandpiper.

Common on inland jheels, less so on the Ganges.

Tringa stagnatilis, Bechstein. The Marsh Sandpiper. (26th August).

Common on inland jheels, less frequently met with on the Ganges. This bird should be removed to the genus *Glottis;* the pattern of its plumage is very similar to that of the Greenshank and its bill is also upturned.

Tringa hypoleucos, Linn. The Common Sandpiper.

Only noticed on the Ganges where it is usually solitary.

Tringa glareola, Linn. The Wood Sandpiper. (26th August).

Plentiful both on inland jheels and on the Ganges.

Tringa t. totanus, Linn. The Redshank. (26th August).

Very common on the Ganges where it is sometimes met with in very large flocks, also observed on the jheels.

Tringa erythropus, Pallas. The Spotted Redshank. (26th August).

Frequently taken on inland jheels, rarely observed on the Ganges.

Glottis nebularia, Gunn. The Greenshank.

Extremely common on the Ganges, also seen on jheels.

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Philomachus pugnax, Linn. The Ruff and the Reeve. (26th August.

The number of these birds which are hawked about by bird-catchers is enormous; they are found in very large flocks on jheels. I have never noticed them on the Ganges. These birds are most variable in colouration and I have collected about eight different phases in plumage but none had ruffs.

Erolia m. minuta, Leisler. The Little Stint. (27th August).

Very common both on the Ganges and on jheels; many birds were in summer plumage on arrival.

Erolia temminckii, Leisler. Temminck's Stint. (10th October).

Common on jheels, less on the Ganges.

Erolia testacea, Pallas. The Curlew Stint. (8th September).

A few specimens taken on jheels.

Erolia a. alpina, Linn. The Dunlin.

Taken on the Ganges only.

Limicola falcinellus sibirica, Dresser. The Eastern Broad-billed Sandpiper. (8th September).

A few specimens taken on jheels.

Capella g. gallinago, Linn. The Common Snipe. (29th September).

A few taken on jheels.

GULZARBAGH, PATNA. E. A. D'ABREU, F.Z.S.

December 19, 1936.

XXIV.—SARUS FLOCKS.

A letter on this subject appeared in your August issue. I have noticed that Sarus Cranes flock together in India (Rajputana) and in Burma (Karenni), but if I remember right they only do so at a certain season of the year—in March and early April. I have put such gatherings down to an annual, matrimonial gathering where and when the young birds are given the opportunity of meeting their kind and advice that parents usually offer to their children on such occasions. I believe such marriage marts are held in the case of other species of cranes and any information on the subject from naturalists who can tell us about them would be most interesting. Does not a certain amount of dancing take place before the debutantes?

TAUNGGYI, S. SHAN STATES. T. R. LIVESEY.

September 30, 1936.

[Sarus Crane are usually found in pairs or accompanied by one or two young. Occasionally these crane collect in flocks, but whether

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in large or small numbers, the birds are always in pairs each pair acting independently of other pairs forming the flock. Such congregations of Sarus, it is explained, are due to the birds collecting in dry weather or seasons of drought, in the few localities where water is available. The monsoon sees their dispersal. In Hume and Marshall's *Game Birds of India* there is an interesting note by Mr. Davis who observed flocks of Burmese Sarus (a racial form with identical habits) in the month of August in mid-monsoon. He saw several flocks of these birds in the *khendas*, 12 miles north at Thatone. They varied in number from 8 or 10 to fully 60, and contained birds of both sexes. The appearance of these birds in large flocks early in August, and the fact that Dr. Anderson had also observed large flocks passing overhead at Prome, apparently migrating, led Hume to enquire whether the species is not to a certain extent migratory in Burma. Numbers of the Upper Burma birds, coming south near the Gulf of Martaban to breed? There seems to be little doubt that conditions of water and food cause Sarus to congregate in favoured areas, but whether Sarus are locally migratory in India or Burma and whether the birds congregate before migrating is a point which requires further observation.

The common Crane (*Megalornis grus*) and the Demoiselle crane (*Anthropoides virgo*), both species in which the tribal instinct is more strongly developed and which usually gather in great flocks, arrive at their breeding grounds in flocks of two to three hundred individuals. About the second week after arrival, the flocks break up into pairs, which disperse all over the country, but even when so dispersed, the birds were observed to reassemble in the morning and evening and go through those curious antics described as dancing. The Sarus indulges in similar exercises but never in assemblies. Captain Butler says that in the breeding season two old birds may be seen engaged in a kind of 'nautch', they spread their wings and lower their necks until they look like two game cocks about to fight; then all of a sudden they raise themselves and begin to dance, trumpeting loudly all the time. Then one or the other springs high into the air descending again to perform the same absurd antics.—EDS.]

XXV.—A MUGGER (*CROCODILUS POROSUS*) WITH A BROKEN LOWER JAW.

I enclose a photograph of the skull of a mugger measuring 5 ft. 10 in. in length which I shot in September 1936. It will be seen that the lower jaw on the left side had been broken and displaced causing the jaw to twist to one side. The result was that the teeth of the lower jaw on the other side came in contact with the palate and had formed small sockets in which they rested.

The skin covering the jaw had evidently been cut through but had healed, leaving a lighter line which can be seen in the side view of the head.

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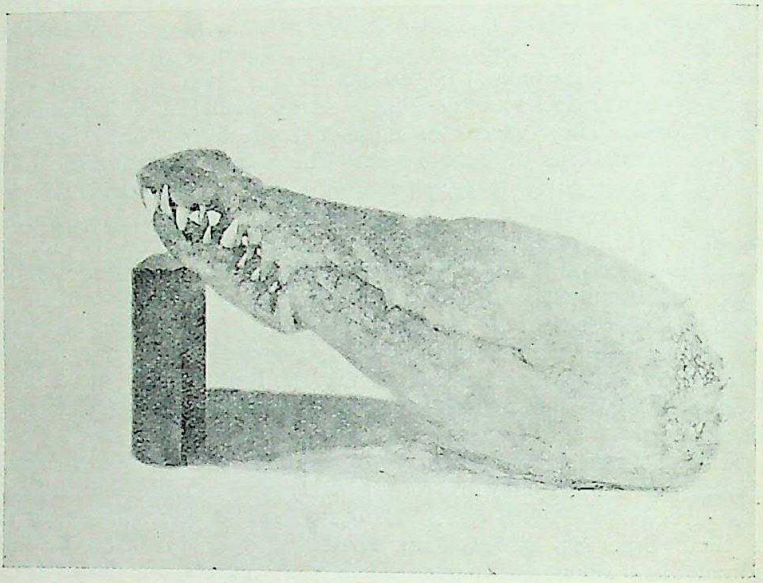
The head was boiled to examine the bones near the break and it was found that the broken ends of the jaw had been joined by a new growth of bone which had a spongy appearance. It



appeared that the injury may have taken place only a few months previously as the join in the bones opened out due to the boiling. The mugger was in normal condition.

While on the question of injuries noted on crocodiles it may be of interest to record that Mr. C . V. Stephens, Executive Engineer, P.W.D., Tanjore, shot a crocodile measuring 9 ft. 7 in. in September 1936 with the right front foot missing from above the elbow joint. The injury was an old one and had quite healed, the crocodile being in good condition and in no way handicapped by the loss of almost the entire limb.

With my previous note No. XXVII on page 184 of vol. xxxix, No. 1, of the *Journal* and the Editor's note on the same article it is observed that there are now three recent records of crocodiles with missing right fore feet and it raises an interesting point as to how the right fore leg appears to be injured in each case and the cause.

If the loss is due to fighting it seems to point to the fact that a favourite grip must be by the fore legs which are damaged in consequence.

It would be of interest if members recorded instances that are known to them of crocodiles with similar or more serious injuries.

TANJORE,
December 30, 1936.

C. H. BIDDULPH.

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XXVI.—NOTES ON THE POND TERRAPIN (*GEŒMYDA T. TRIJUGA*) IN SALSETTE ISLAND.

During the early part of the monsoon, I obtained two female specimens of *G. t. trijuga* through Mr. H. Ali. Both specimens were caught at Andheri. This species is apparently common on the island, but is seldom seen on account of its nocturnal habits. During the rains they wander about much at night.

Both the specimens referred to I kept in captivity. During the early part of October, I cast one of them for the Museum. When opened it was found to contain numerous eggs, the largest of which were about 1.5 cm. in diameter and quite spherical. On the 20th of the same month, the surviving terrapin laid five eggs in her cage, early that morning. The five eggs were laid in fairly quick succession. The two largest measured 48 × 26 mm. each, the next in size 46 × 27 mm. and the remaining two 44 × 26 and 44 × 25 mm. respectively. These measurements agree fairly well with those given in the *F.B.I.* (new ed.) Reptilia, for the race *G. t. thermalis* from Ceylon.

The eggs are elliptic, narrowing down slightly towards the poles. Both the poles are equally domed. The shell is firm and calcarious, white, with a slight pinkish tinge.

With regard to food, I am of the opinion, that this species is entirely vegetarian. The captives, referred to, refused to take meat of any kind, but would always readily take such vegetable as tomatoes, and cucumbers (they were very partial to the latter), but would not eat pumpkins. They would occasionally eat boiled rice from the dog's plate.

These creatures appear to be very docile, never attempting to bite or to fight among themselves, though sometimes one would snap at the other over food. The two lived on amicable terms with a Star-shelled Tortoise (*Testudo elegans*) in the same cage.

The scent glands in this species are well known, and I can only confirm this. When very agitated these terrapins emit a very powerful and disagreeable stench—presumably a means of defence.

BOMBAY NATURAL HISTORY SOCIETY,

BOMBAY. C. McCANN.

October 25, 1936.

XXVII.—NOTES ON THE BREEDING OF THE RAT-SNAKE OR DHAMAN (*ZAMENIS MUCOSUS*)

Col. F. Wall referring to the breeding of the Rat-Snake (*Z. mucosus*) in his interesting serial published in the *Journal* entitled, 'A Popular Treatise on the Common Snakes of India' (vol. xiii, p. 268), remarks that the periods of gestation and incubation are

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unknown to him, yet he gives the periods of deposition of the eggs and hatching with fair accuracy.

On several occasions I have observed these snakes in copulation during the months of April, May and June. Specimens dissected in June and July have had eggs in the uterus. On the 11th August this year (1936) eleven eggs were taken a few inches under the soil. The number of eggs for this species as recorded by Col. Wall is between nine and fourteen. The eggs were in the shape of a long ellipse with both the poles equally domed; chalky white and non-adherent. (Wall: 'The eggs laid in adherent clusters and deposited, I believe, in holes in the earth. They are white, glossy and parchment-like, with the poles equally domed.') The largest egg measured 50 × 25 mm. and the smallest 43 × 24 mm.; the others were all in the neighbourhood of 46 × 26 mm. These measurements agree well with those recorded by Nicholson (2″ × 1¼″).

On opening one of the eggs I discovered that it contained an embryo about seven to ten days old. The remaining ten eggs I kept in a desiccator with a little water at the bottom, while the eggs rested on a tray above. At intervals I opened the eggs to get an embryological series. At first the egg shells were firm and quite taut, showing no indentations, but as development progressed the shell showed deep depressions here and there. On the 12th November I opened the last eggs that I had kept to hatch to establish the identity of the species. On this day the egg looked as though it was going bad, which was really the reason for my opening it. To my surprise, I discovered that it contained a nearly mature embryo, which would have come out in about four days to a week. Allowing ten days in the beginning and another seven days at the end this would give us an aggregate of 110 days (or three months and twenty days) as the incubation period.

Bombay Natural History Society,

Bombay. C. McCANN.

November 15, 1936.

XXVIII.—SNAKES' METHOD OF SWALLOWING PREY.

With reference to the remarks on the manner in which snakes swallow their prey in the very interesting article on the 'Snakes of Deolali' which appeared in the last number of the *Journal*, the following experience may be worth recording.

As I was passing a small pond some years ago, a large frog quite three and a half inches in length of head and body, leapt off the bank into the water and was instantly seized by the hindleg by a snake which had been lying in hiding behind a stone half in and half out of the pond. The snake was about two and a half feet long and of slender build, the head being little more

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than half an inch across at its widest. Though it looked a physical impossibility for it to swallow the frog, the snake had no doubts on the matter and retreating to its lair behind the stone, set to work. It had caught the frog about halfway down the leg, and it first worked its way back till the foot was in its mouth and then started literally to crawl outside its victim. The jaws worked alternately from side to side. Getting a purchase with the top jaw, there followed a violent heave until the lower jaw could grip a little further on, the two becoming entirely dislocated and the gape enormously stretched as it reached the thicker portion of the frog's body. The frog struggled violently until one leg was engulfed after which it seemed to become resigned to its fate and lay quite passive though still alive. Reaching the base of the first leg, the snake worked its way across the caudal region of the body and with considerable difficulty managed to double up and swallow the other hind leg. After that it was comparatively plain sailing though the gape and throat looked as if they might split at any moment. The whole process took about twenty minutes.

In this case the snake made no attempt to turn the frog round and swallow it head first. If it had tried to do so, it (the latter) would very probably have managed to break away, and it seems likely that most small, non-venomous snakes which devour their prey alive must swallow it as they catch it in whatever position it may be.

COOVERCOLLY,

SOMWARPET, COORG. F. N. BETTS.

January 8, 1937.

XXIX.—THE GIANT WOOD SPIDER.

I give below an account of the interesting behaviour of a species of small fly with a Giant Wood Spider (*Nephila maculata*) which is very common in the Coffee at this time of year. If you consider it worthy of record please publish it in the *Journal*.

During Coffee crop harvesting operations I noticed one of these spiders on the top of a Coffee bush having had its web torn down and was surprised to see a small fly crawling about one of its palpi. I watched to see what the spider would do to such a daring adventurer; but not content with its dangerous position the fly stepped on to the mandibles and put its head seemingly into the very jaws of its giant hereditary enemy. In a few seconds I was watching with even closer attention as the fly's abdomen was visibly swelling with the intake of some liquid and when about twice its original size the fly departed. Now what was the liquid imbibed from the lips of so formidable an enemy of all flies in general? Was I a witness to the equivalent, in the Arachnid tribe, to the African Crocodile Bird?

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Further investigation may bring fresh light on the subject, but the fly being so small and easily overlooked there is remote chance of ever seeing such an interesting incident again. The spider took not the slightest notice of the fly, at anyrate did not appear to resent its presence. I was unable to see exactly how or from whence the fly sucked up the liquid as the nearer I moved my head the further the spider moved away.

NADUAR ESTATE,
VALPARAI P.O., S. INDIA.
January 20, 1937. R. N. CHAMPION-JONES.

XXX.—NOTES ON THE MOULTING PROCESS OF THE SPIDER (*MYRMARACHNE PLATALEOIDES*, CAMB.)

(*With four text figures*)

Though it is generally believed that the spiders do not undergo any metamorphosis except the development of the palpal organs in the males after their final moult, yet a kind of transformation not only in the tarsal segment of the pedipalp of the male but also in the mandibles, teeth and fangs takes place in *Myrmarachne plataleoides*, Camb., and some other of *Attid spiders*.

Sometime ago I collected a specimen of *Myrmarachne plataleoides*, apparently a female, and put it in a glass tube. The next morning I was surprised to note a remarkable change in the contour of its body. The specimen had, by now, become a fully developed male, provided with the copulatory organs at the digital joints of the palpi; the chelicerae being nearly half as long as the body. These characteristics were not at all noticeable on the previous day when the specimen was actually collected. This marked transformation led me to investigate the details of the moulting habits of this species of spider, particularly with reference to the changes that occur during the final moult.

Colour.—After emergence from egg, the young *M. plataleoides* looks yellow with a continuous black line over the anterior row of eyes. The young ones come out of the retreat after 5 or 6 days. They measure about 1 to 1·5 mm. in length. At this stage the dorsum of the cephalothorax is almost black with a slight yellowish tint. The anterior portion of the abdomen, both dorsally and ventrally, is orange or reddish-yellow in colour, while the posterior half is deep black. The cephalic portion is high and flat, but the thoracic portion slopes with a slight upward curvature in the middle; the abdomen is oval with a slight depression on the dorsum.

Moults.—Within seven to ten days after emergence from the retreat, the young spider changes its skin. The second moult takes place ten to fifteen days after the first, a slight depression appearing at the middle of the cephalothorax. The young spider now appears

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rather broader than long owing to the shortness of the pedicel. After the third moult, the body becomes elongated and assumes the form characteristic of the species. The blackish shade of the anterior portion of the body is by this time replaced by a reddish-yellow tint, while the region round the eyes retains the original blackish shade which persists throughout life. Two or three days after the fourth ecdysis, the abdominal black tint disappears within a few hours. An orange or yellow colour then becomes prominent all over the body with a few black specks on the cephalic region. The appearance or disappearance of markings or spots in the spider follows each fresh moult. After the fifth moult, the spider approaches the normal size of an adult, the colour becoming brick-red with distinct white markings on the dorsal aspect of the abdomen and on the sides of the cephalothorax.

Uptil the final moult (i.e. the sixth) all the immature forms resemble mature females, the sexes becoming distinct after the final moult. The habit, biology, external structures, size, colour and markings of the body and even the number and arrangement of teeth in the chelicerae of the sex-undetermined immature forms are in all respects similar to those of the mature females. The tibial and tarsal joints of the pedipalpi of both mature and immature forms are identical. The distinction between the two sexes before the final moult is so negligible that immature specimens cannot be separated with respect to their potential sexes (Fig. 1).

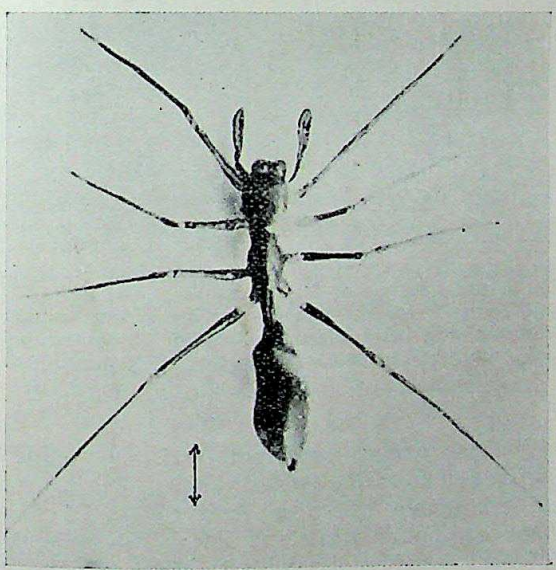

Fig. 1.—Enlarged photograph of a sex-undetermined specimen of *M. plataleoides*, after the penultimate moult.

Very striking changes take place in the immature forms of the male sex, (potential) during the final moult. Two or three days

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previous to casting off its last integument the immature spider spins an oval shaped retreat composed of loosely woven silk and rests quietly within it without taking any food. During the progress of moulting the spider attaches itself to the thread of the retreat by the claws of its legs. The old chitinous cuticula covering the dorsum of the cephalothorax is the first to give way laterally and is raised up like a lid hinged, as it were, to the posterior extremity of the cephalothorax (Fig. 2).

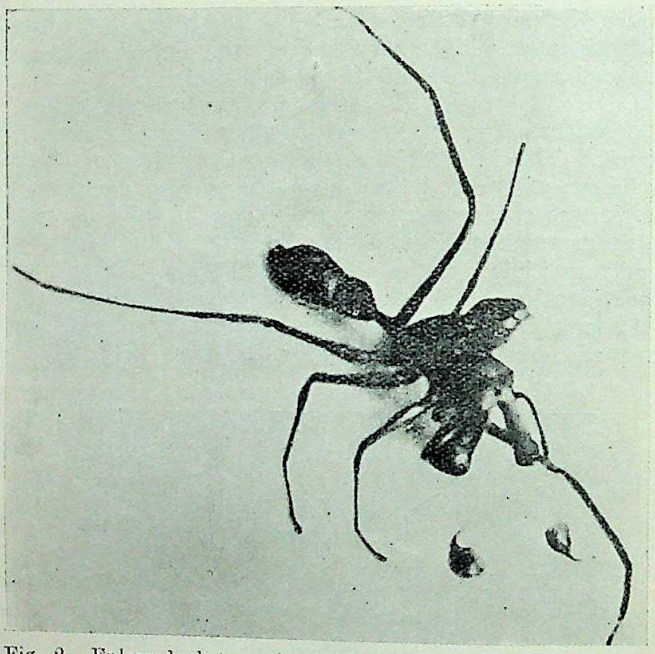

Fig. 2.—Enlarged photograph of the process of the final ecdysis of the apparent female of *M. platalcoides*. The cuticle of the cephalothorax is raised upwards and the minute mandibular cuticles are cast off (shown in front of it) and two club-shaped mandibles are seen in progress of growing.

The body then works itself out and the appendages are gradually disengaged from their exoskeleton. During this progress the chelicerae are drawn out from their old cuticle and undergo growth and transformation while still soft. The pedipalpi are then drawn out of the slough along with the first and second pair of legs. The palpi which were flat before the last moult become now rounded and provided with a copulatory bulb and a tibial apophysis or copulatory claw, as we might call it, since it plays an important part during the act of mating. When the newly formed dorsal shield of the cephalothorax has become exposed by the uplift of the old cuticle, a pair of stump-like bodies, which are flat on

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the upper and inner faces, appear to come out, from inside the original minute mandibular integument by pushing upwards (Fig. 3).

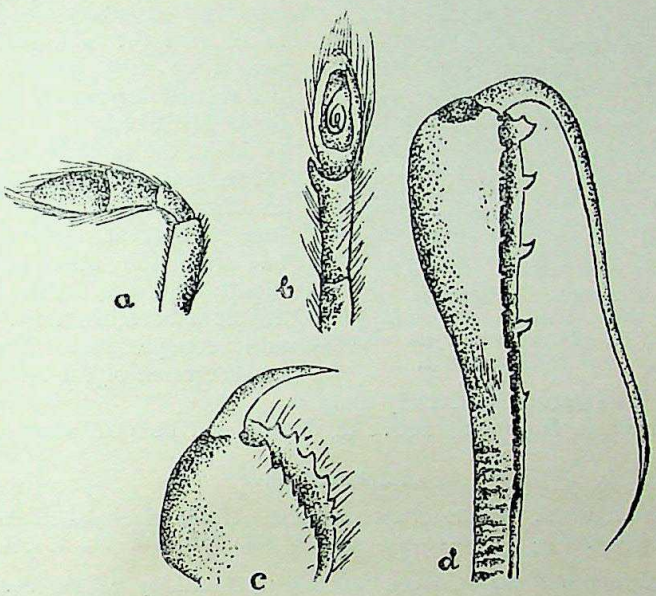

Fig. 3.—*a* External structure of the pedipalp of sex-undetermined specimen and adult female of *M. plataleoides*; *b* the pedipalp of the male after the final moult; *c* the chelicera of the sex-undetermined specimen of *M. plataleoides*; *d* the chelicera of male which grows out of a minute one as shown in *c* during the final moulting.

After a few minutes, globular swellings with rudimentary uncinate processes appear at the apices of these stump-like bodies. Gradually these swellings increase in length and project out in the same plane as the cephalothorax. As a result of this growth, the chelicera becomes half as long as the spider's body. The uncinate processes, which are articulated at the apices of the cheliceræ, gradually begin to show signs of rapid growth and extend as far as the bases of the cheliceræ. The length of the uncinate process equals that of the chelicera. The inferior ridge in the chelicera comes out of the old cuticle armed with about twelve to fourteen teeth, all of which are bent forward and placed at equal intervals throughout the whole length of the stem, while the superior ridge contains five teeth equally distributed in the fore half of the chelicera. The basal half of the chelicera, when viewed dorsally, looks transversely rugose and its extremity assumes abrupt enlargement, giving the spider much the appearance of a spoon-bill. Black spots, which are absolutely absent before the moulting, appear at the apices of the cheliceræ. The third and fourth pair of legs come out of

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the old cuticle almost simultaneously along with the abdomen (Fig. 4).

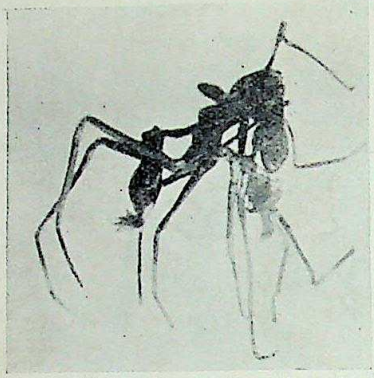

Fig. 4.—Enlarged photograph of the second stage of final moult of *M. plataleoides* (♂). Extrication of the abdomen and hind legs is in progress.

The whole process of the last moult is completed within half an hour or so. After the moulting is over, the spider takes rest for a considerable period of time during which the whitish colour of the body turns brick-red.

With the females, however, the armature of the epigynum characteristic of the adult females becomes fully developed after the sixth or final moult, and the colour of the atriolum becomes dark brown and conspicuous. The immature form of the female sex by this time becomes sexually mature.

A paper dealing with above in details will be published later.

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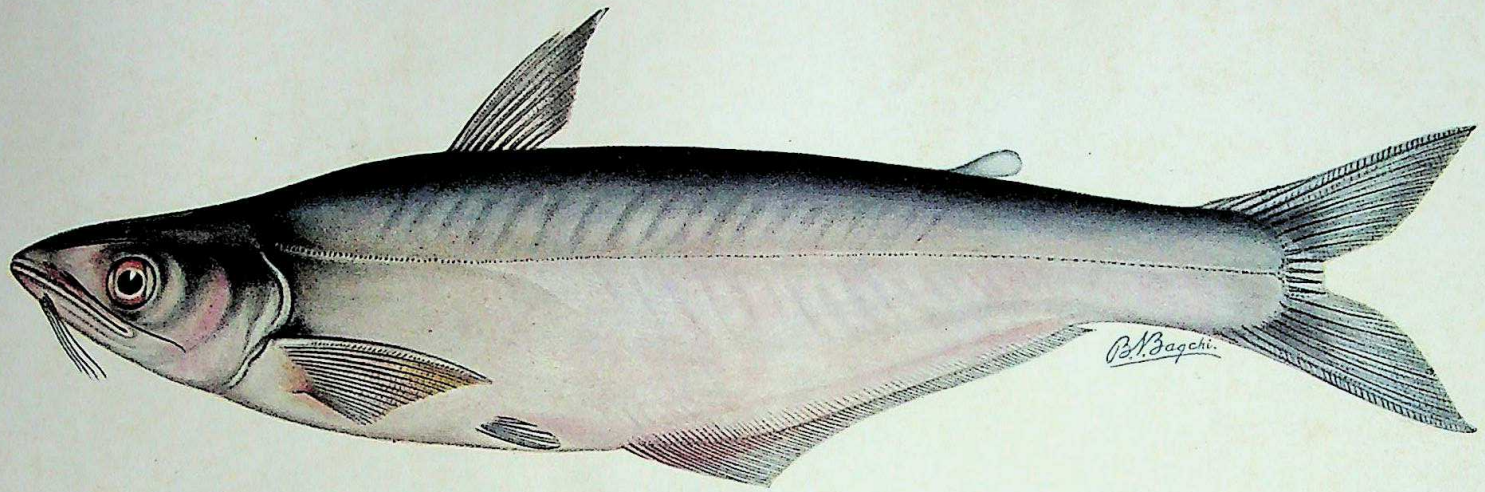

THE BACHHWA OR BUTCHWA.
Eutropiichthys vacha (Hamilton).

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THE GAME FISHES OF INDIA[1]

BY

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(*With one plate and eight text-figures*).

Continued from page 210 *of* Vol. xxxix.

II.—'THE BACHHWA OR BUTCHWA'.[2]

EUTROPIICHTHYS VACHA (HAMILTON).

CONTENTS.

	PAGE
Introduction	431
Taxonomy	
Nomenclature and Systematic Position	432
Synonymy and Description	436
Measurements, Distribution and Variation	438
Bionomics and Fishing Notes	442
Acknowledgments	445
List of References	445

INTRODUCTION.

There are two types of Catfishes which are termed *Butchwa* among anglers. In Bengal, where both species are found in abundance, the name *Bāchchā* is invariably applied to *Eutropiichthys vacha* (Ham.), an elegant fish with a large mouth, as in the 'Indian Trout' (**15**).[3] The other species, known as *Garua* or *Garua*

[1] Published with permission of the Director, Zoological Survey of India.
[2] Also known as *Batchwa, Batchúa, Váchá* and *Báchchá*.
[3] Numerals in thick type within brackets refer to the serial numbers of the various publications listed in the bibliography at the end of the paper.

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Bāchchā, has a much smaller mouth and, though belonging to the same family *Schilbeidae*, is included in a separate genus, *Clupisoma* Swainson. It may be noted that in all books on angling in India the accounts of these two types of *Butchwa* are greatly confused. It is proposed, therefore, to give a description of the true *Bāchchā* in this article, and to reserve the treatment of *Clupisoma garua* (Hamilton) for the next.

Taxonomy.

Nomenclature and Systematic Position.

The species was originally described by Hamilton (13) as *Pimelodus vacha* and was included by him among a heterogeneous assemblage of Catfishes. Swainson (21) assigned it to the genus *Pachypterus* and named it *P. punctatus*, while Cuvier and Valenciennes (4) considered it to be a *Bagrus*. Bleeker (2) also regarded it as a *Bagrus* in the first instance, but later he (3) defined its precise limits and proposed for its reception a new genus *Eutropiichthys* in his group Pangasii. The genus was defined as:

'Cirri 8, nasales 2, supramaxillares 2, inframaxillares 4. Dentes maxillis pluriseriati. Dentes vomerini vel palatini nulli. Oculi superi. Rictus sub oculo productus.'

This diagnosis appears to have been based on Hamilton's original description and figure, for it is stated therein 'In both are crowded numerous sharp *teeth*, of which there are none on the palate.' Günther (11), without examining any specimen of Hamilton's species, accepted Bleeker's genus; but Day (5) pointed out that in *E. vacha* there are

'villiform teeth in a triangular spot on the vomer, and in a large pyriform shape on the palate; the whole of these with those on the upper jaw are so closely set together that it may give the appearance on a superficial examination that there are "no teeth on the palate" as remarked by Dr. Günther.'

Day (6) was also the first to describe the air-bladder of *E. vacha* as

'narrow, tubiform, placed transversely across the body of the anterior vertebrae, and all but its central portion enclosed in bone, either expanded extremity being within a bony capsule.'

Though in the original definition of *Eutropiichthys* no mention is made of the teeth on the palate and of the nature of the air-bladder, these form the chief diagnostic features of the genus which may be defined as follows:

The body is elongate and compressed. The head is covered with soft skin. The snout is pointed; usually it is sharp but in some specimens it is slightly blunt. There is a narrow median fontanel on the head, commencing slightly behind the posterior nostrils and extending almost to the termination of the occipital

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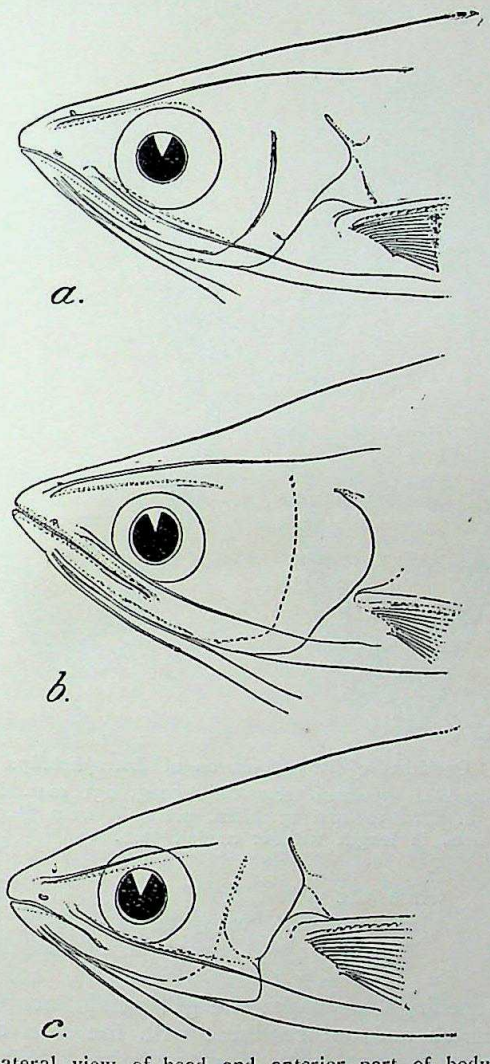
process. *The mouth is wide and ascending;* it reaches below the orbit or may slightly extend beyond the posterior margin of the orbit. The upper jaw is slightly longer. The nostrils are wide apart. The eyes are lateral and are provided with broad adipose lids.



Text-fig. 1. Lateral view of head and anterior part of body of the three species of *Eutropiichthys* Bleeker.

a. E. goongwaree (Sykes), ×1⅜; *b. E. vacha* (Ham.) ×1⅛; *c. E. murius* (Ham). ×1⅜.

There are eight barbels, one pair nasal, one pair maxillary and two pairs mandibular.

The jaws are provided with several rows of sharp, villiform teeth; the toothbands are produced backwards at the sides. *The*

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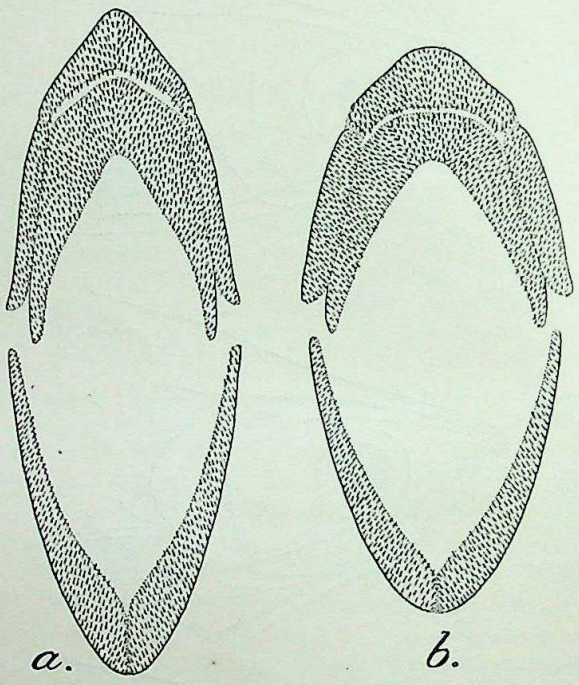
teeth (fig. 2) on the palate form a continuous vomero-palatine band which is also produced at the sides. The band is sometimes interrupted in the middle and sometimes it is so close to the maxillary band that the two appear to be contiguous. The rayed dorsal fin is short, with one spine and seven rays. The adipose dorsal is also short and is situated far behind. The pectoral fin is provided



Text-fig. 2. Dentition of two specimens of *Eutropiichthys vacha* (Ham.).

a. Long-snouted specimen from Chittagong, 251 mm. in length without caudal. ×1½; *b*. Blunt-snouted specimen, probably from Burma (*A.S.B. Cat.* No. 484), 192 mm. in length without caudal. ×2.

with a spine, while the pelvic fin has only six rays. The anal fin is long, but is separated from the caudal by a considerable distance; it has usually 47-50 rays. The caudal fin is deeply forked.

The gill-openings are wide; the gill-membranes being separated by a deep notch and not confluent with the skin of the isthmus. The branchiostegal rays vary from 5 to 11.

The air-bladder (fig. 3) is greatly reduced, tubular and transverse; it lies closely applied to the ventral surface of the anterior vertebrae and forms a circular loop incomplete anteriorly; it is not enclosed by bone but is supported on the dorsal surface by the bony extensions of the transverse processes of the anterior vertebrae.

The characters italicised above are the most important diagnostic features of the genus, and have afforded me a clue to

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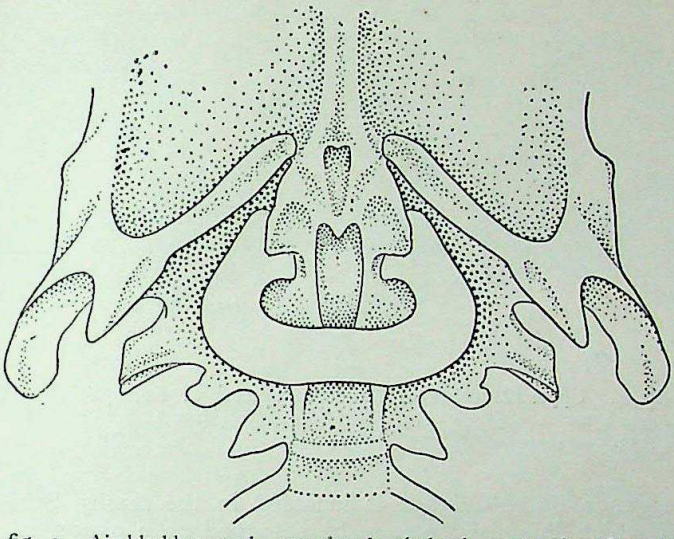
refer two more species—*Pimelodus murius* Hamilton (**13**, p. 195) and *Hypophthalmus goongwaree* Sykes (**22**, p. 369) to the genus



Text-fig. 3. Air-bladder and associated skeletal parts in *Eutropiichthys vacha* (Ham.). Length of specimen 152 mm. without the caudal. ×5

Eutropiichthys. The three species may be distinguished by the following key :

A. Vomero-palatine band interrupted in middle (fig. 4, *a*) ; cleft of mouth extending to below first third of eye ; nasal barbel extending to base of dorsal ; eye $2\frac{3}{4}$ in length of head (fig. 1, *a*). *E. goongwaree* (Sykes).

B. Vomero-palatine band complete in middle.

a. Vomero-palatine band wider than maxillary band (fig. 4, *b*) ; branchiostegals 11 ; cleft of mouth nearly extending to hind border of orbit ; nasal barbel rarely extending to hind border of head or slightly beyond ; eye 3-$4\frac{1}{2}$ in length of head (fig. 1, *b*) ... *E. vacha* (Ham.).

b. Vomero-palatine band narrower than or just as wide as maxillary band (fig. 4, *c*) ; branchiostegals 5 ; cleft of mouth extending to front edge of eye ; nasal barbel extending to short distance behind posterior edge of eye ; eye 3-$3\frac{3}{4}$ in length of head (fig. 1, *c*) *E. murius* (Ham.).

Both *E. goongwaree* and *E. murius* were referred to the genus *Pseudeutropius* Bleeker by Günther (**11**) and Day (**8**, **9**) ; though their authors had indicated their close similarity to Hamilton's *Pimelodus vacha*. It is outside the scope of this work to discuss in detail the relationships of the three species. It may, however, be indicated that from the point of view of an angler their specific characteristics should make very little difference. *E. goongwaree* is found in the rivers of the Deccan, and was originally described from the Mota Mola river near Poona. *E. murius* is known from

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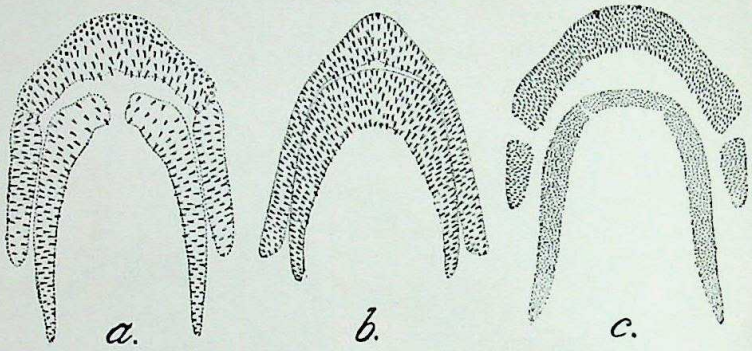
the 'Rivers of Sind, Orissa, the Jumna and rivers of Bengal and Assam'. *E. vacha* is still more widely distributed and besides northern India it is found in Burma and Siam.



Text-fig. 4. Upper dentition of the three species of *Eutropiichthys* Bleeker. *a. E. goongwaree* (Sykes). ×3⅔; *b. E. vacha* (Ham.). ×1⅓; *c. E. murius* (Ham.). ×5⅓.

The genus *Eutropiichthys* is included in the family Schilbeidae (19), of which Pangasiidae may be regarded as a synonym. This family occurs in Indo-China, Siam, the Malay Peninsula and the Archipelago, Burma, India and the tropical parts of Africa.

The Schilbeidae are a family of the Sub-order Siluroidea of the Order Ostariophysi. They are popularly known as Catfishes, on account of their long barbels.

Synonymy and Description.

Eutropiichthys vacha (Hamilton).

1822. *Pimelodus vacha*, Hamilton, *Fish. Ganges*, pp. 196, 378; pl. xix, fig. 64.
1839. *Pachypterus punctatus*, Swainson, *Nat. Hist. Fish.* etc., ii, p. 306.
1839. *Bagrus vacha*, Cuvier and Valenciennes, *Hist. Nat. Poiss.*, xiv, p. 392.
1854. *Bagrus vacha*, Bleeker, *Verh. Bat. Gen.*, xxv, pp. 56, 112.
1862. *Eutropiichthys vacha*, Bleeker, *Versl. Akad. Amsterdam*, xiv, p. 398.
1863. *Eutropiichthys vacha*, Bleeker, *Ned. Tijdschr. Dierk.*, i, p. 107.
1864. *Eutropiichthys vacha*, Günther, *Cat. Fish. Brit. Mus.*, v, p. 38.
1869. *Eutropiichthys vacha*, Day, *Proc. Zool. Soc. London*, p. 306 (*dentition*).
1869. *Eutropiichthys vacha*, *Günther, Zool. Rec.*, p. 134 (*dentition*).
1871. *Eutropiichthys vacha*, Day, *Proc. Zool. Soc. London*, p. 713 (*air-bladder*).
1873. *Eutropiichthys vacha*, Day, *Rep. Freshw. Fish. Fisheries, India and Burma*, p. 270.
1877. *Eutropiichthys Burmanicus*, Day, ibid., p. 490.
1877. *Eutropiichthys vacha*, Day, *Fish. India*, p. 490, pl. civ, fig. 6.
1877. *Eutropiichthys vacha*, Beavan, *Freshw. Fish. India*, p. 131.
1880. *Pseudeutropius goongaree*, Vinciguerra (*nec* Sykes), *Ann. Mus. Civ. Stor. Nat. Genova*, xviii, p. 91.
1889. *Eutropiichthys vacha*, *Faun. Brit. Ind. Fish.*, i, p. 128, fig. 55.
1889. *Eutropiichthys burmanicus*, Day, *Faun. Brit. Ind. Fish.*, i, p. 128.
1890. *Eutropiichthys vacha*, Vinciguerra, *Ann. Mus., Civ. Stor. Nat. Genova* (2), ix, p. 71.

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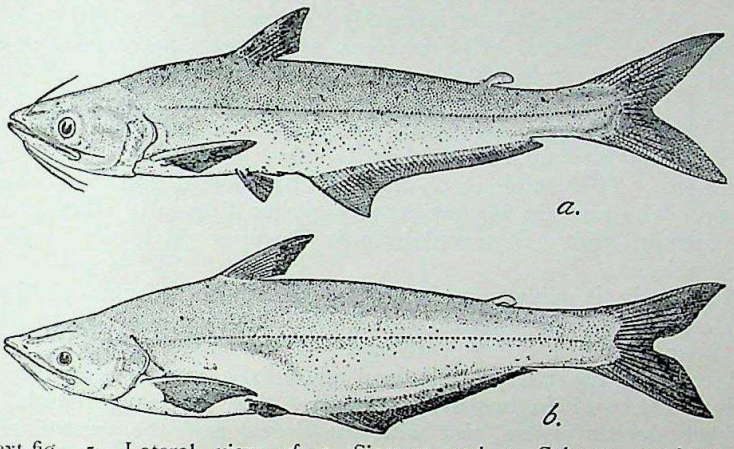
1894. *Eutropiichthys vacha*, Bridge and Haddon, *Phil. Trans. Roy. Soc. London* (B), clxxxiv, p. 201 (*air-bladder and skeleton*).

1929. *Eutropiichthys vacha*, Prashad and Mukerji, *Rec. Ind. Mus.*, xxxi, p. 175, figs. 2 and 3.

Vernacular names.—*Vacha* (Dinajpur, Goalpara, Calcutta); *Tunti, Kangon* and *Caingun* (Lakshmipur); *Katla* (Purniah); *Bachoya* (Bhagalpur); *Sugwa-bachoya* (Patna); *Butchua* and *Nandi butchua* (Orissa); *Chel-lee* (Sind); *Nee-much* (N. W. Sub-Himalaya); *Nga-myen-kouban, Katha-boung* and *Nga-myee ying* (Burma); *Nga-glaung* (Myitkyina District, Upper Burma).



Text-fig. 5. Lateral view of a Siamese and a Calcutta specimen of *Eutropiichthys vacha* (Ham.) of about the same length. $\times \frac{3}{10}$.
a. Siamese example; *b*. Calcutta example.

B. 11; D. 1/7 | 0; A. 3-4/41-52; P. 1/13-16; V. 6; C. 17.

The length of head is contained from $5\frac{1}{2}$ to $5\frac{3}{4}$ times in the total length and $4\frac{1}{5}$ to 5 times in the length without the caudal. The height of the body is very variable in specimens from different localities; in a specimen from Siam the body is very narrow, but it gradually becomes deeper in specimens from Burma, Chittagong, Calcutta and the Panjab. The depth of the body is contained from $4\frac{1}{6}$ to 5 times in the total length without the caudal. The snout is invariably pointed, but in very rare cases it is slightly rounded. There is a single, narrow and long fontanel on the head. The occipital process is long and pointed; it is nearly 3 times as long as wide. The eye is large, lateral in position and is situated above the cleft of the mouth; it is provided with broad adipose lids. The diameter of eye is contained from 3 to $4\frac{1}{2}$ times in the length of the head; 1 to $1\frac{1}{2}$ times in the length of the snout and $1\frac{1}{10}$ to 1 in the interorbital distance. The gape of the mouth extends to below the posterior margin of the orbit, and is equal to half the length of the head. The upper jaw is slightly longer. There are eight barbels of varying lengths; as a rule, they are longer in young specimens than in adults. In Burmese and Siamese specimens the barbels are relatively longer. As a rule, none of the barbels is longer than the head, but in young specimens and in some Burmese examples they are considerably longer. The two pairs of mandibular barbels are situated almost

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in a row. The teeth are sharp and villiform; those on the jaws form broad bands which are produced backwards at the sides. The vomero-palatine band is considerably broader than the maxillary band and is pyriform in shape; this band is sometimes so close to the maxillary band that the two are indistinguishable from each other.

In Indian specimens the dorsal fin commences slightly in advance of the ventrals, while in Burmese and Siamese examples it is either opposite or slightly behind the origin of the ventrals. The dorsal spine is weak and faintly serrated along its posterior edge; it is almost as long as the head, excluding the snout. The pectoral fins extend beyond the origin of the ventrals; the pectoral spine is roughened externally and serrated internally; the rugosity of the outer surface is more pronounced in Burmese specimens. This spine is as long as the dorsal spine or slightly longer. The anal fin is considerably higher anteriorly than towards its posterior end. The caudal fin is deeply forked with both the lobes pointed.

The body is silvery with the back greyish—a neutral tint of cobalt blue. There are patches of vermilion of different shades on the jaws, upper and lower margin of the orbit, gill-cover, base and rays of the pectoral fin and along the ventral edge of the body. The anal fin has a light neutral tint, while the caudal has a much deeper neutral tint with the dorsal and the ventral edges light. The anterior half of the dorsal fin and the whole of the adipose dorsal are of the same colour as that of the back.

Measurements, Distribution and Variation.

Day (**8**) gives the distribution of *Eutropiichthys vacha* as 'From the Punjab through the large rivers of Sind, Bengal, Orissa, and variety *E. Burmanicus* in Burma'. Quite recently Suvatti (**20**) extended its range to Siam. The Mahanadi river in India probably forms its southernmost limit as it has not so far been recorded from the Deccan.

The Burmese specimens were separated by Day into a distinct variety *burmanicus* which he characterised as follows:

'Variety *Eutropiichthys Burmanicus* has A. 4/55, and its nasal barbels almost reach to the dorsal fin; the maxillary to the middle of the pectoral spine, whilst all the others are longer than the head. The pectoral spine is serrated externally, and reaches the anal fin.'

Day does not mention the precise locality in Burma from where he obtained his specimen or specimens of *E. burmanicus*. Vinciguerra (**24**), who examined several examples of *E. vacha* from Mandalay, Bhamo and Bassein did not find any examples of Day's variety. Similarly, Prashad and Mukerji (**18**) who studied Burmese material did not come across this variety. In the collection of the Indian Museum there is a specimen from Burma (Dup. Cat., No. 39) purchased from Day, which has longer barbels (fig. 1, *b*) and the anal fin, but does not quite show the characters of *E. burmanicus*. There are two other specimens fom Mandalay (Dupt. Cat., Nos. 161, 246) which have long barbels, but in them the snout is somewhat blunt. In view of the above the precise

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Measurements [1] in millimetres

	Burma		Chittagong				Hoogli River, Bengal				
	Mandalay.	A.S.B. Cat. 486	Chittagong				Calcutta	Pulta		Kanchrapara	
Total length without caudal ...	131·0	177·0	208·0	204·0	175·0	172·0	156·0	310·0	218·0	189·0	166·0
Length of head	24·0	35·0	41·5	41·0	36·0	35·0	33·0	70·0	48·0	42·0	37·0
Height of head	19·0	27·0	32·0	32·0	26·0	26·0	23·0	56·0	34·0	30·0	27·0
Width of head	11·3	20·0	26·0	26·0	23·0	21·0	18·5	45·0	28·0	25·0	22·0
Width of body	9·5	13·0	23·0	23·0	19·0	18·0	15·5	42·0	24·0	23·0	21·0
Height of body	29·0	39·0	47·0	47·0	41·0	40·0	33·0	75·0	48·0	45·0	40·0
Diameter of eye	8·0	11·0	10·0	10·0	9·0	9·0	9·0	15·2	11·0	10·0	9·0
Interorbital width	9·0	12·2	16·0	16·0	14·0	14·0	11·0	26·0	18·0	14·0	12·4
Length of snout	8·0	11·2	15·0	15·0	12·5	12·3	10·5	21·2	16·0	13·0	11·5
Length of nasal barbel ...	21·0	27·0	18·0	16·0	17·0	18·0	17·0	22·0	19·0	16·0	16·0
Length of maxillary barbel ...	25·0	30·0	22·1	22·0	20·0	20·0	21·5	30·0	22·0	17·5	21·0
Length of outer mandibular barbel	22·0	28·0	19·0	18·0	18·0	18·0	18·0	26·0	20·0	17·0	17·0
Length of inner mandibular barbel	23·0	29·0	20·0	19·0	19·0	19·0	18·5	27·0	21·0	18·0	17·0
Length of pectoral spine ...	23·0	35·0	34·0	35·0	31·0	29·0	26·0	damaged	38·0	33·0	30·2
Least height of caudal peduncle ...	11·5	15·0	18·0	18·0	14·5	14·5	13·8	30·0	20·8	19·0	18·0

[1] Two more tables of measurements are given on pages 441 and 442.

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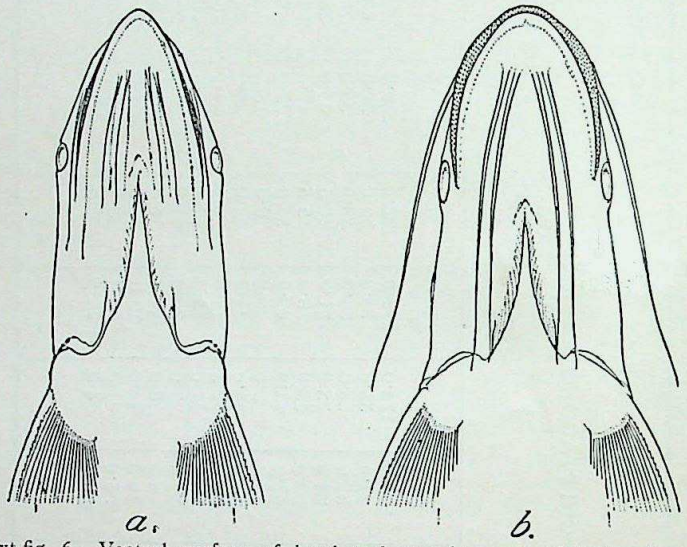
systematic position of this variety becomes very doubtful, and it seems probable that there are some errors in the description.

Prashad and Mukerji (18) observed that

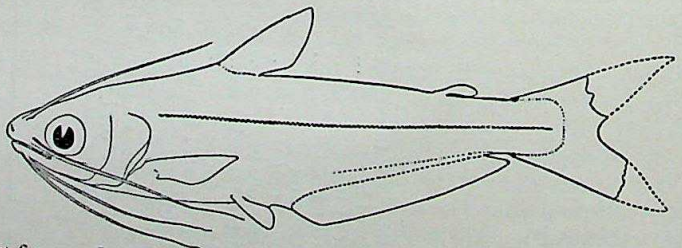
'in addition to Day's *E. burmanicus* there are two more or less distinct forms of *E. vacha* and which can be easily distinguished by their different facies. In the first form the snout is very sharp and pointed and the barbels are short, while in the second form the snout is blunt and more or less rounded and the barbels, though shorter than those of *E. burmanicus*, are considerably longer.'



Text-fig. 6. Ventral surface of head and anterior part of body of a long-snouted and a blunt-snouted specimens of *Eutropiichthys vacha* (Ham.).

a. Long-snouted specimen from Chittagong Nat. size; *b*. Blunt-snouted specimen (*A.S.B. Cat.* 484). ×1⅓.

In the old collection of the Indian Museum there are specimens (A.S.B. Cat., Nos. 484, 486 and Dup. Cat., Nos. 161, 246) which have a blunt snout and somewhat longer barbels. The locality of the first two specimens is not given, but presumably they also came from Burma. Prashad and Mukerji figure a specimen with a blunt snout and give 'Punjab' as its locality. I have not been able to trace such a specimen in the collection, but it seems probable that they figured one of the old A.S.B. specimens.



Text-fig. 7. Lateral view of a young specimen, 36 mm. in length without caudal, of *Eutropiichthys vacha* (Ham.) from Mirzapore, United Provinces. ×2.

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There are three very young specimens from Mirzapore, United Provinces, which throw considerable light on the variations discussed above. In them the barbels are very long, the snout is somewhat blunt and the mouth is not so extensive; the outer margin of the pectoral spine is distinctly roughened. These features show that some of the Burmese specimens, characterised by longer barbels and a blunt snout, have preserved the juvenile characters of the species to a certain extent.

The study of a large number of specimens has also shown that in several respects the Siamese and Burmese specimens represent a distinct race, and in this connection attention may be directed to the forms of *Crossochilus latius* (Ham.) and *Labeo dero* (Ham.) that have been differentiated by Mukerji (17) and Hora (14). It would thus appear that though there is a general similarity between the fauna of India and Burma, the two have remained isolated from each other for a sufficiently long period to have evolved into distinct races. In the case of *Eutropiichthys vacha* I have collected a considerable amount of material from the river Hooghly, but only a few specimens are available for study from Siam and Burma on the one hand, and from the north-western parts of India on the other. It is not possible, therefore, to recognise here any distinct races or subspecies of *Eutropiichthys vacha*.

In order to indicate the probable differences between the Burmese and Indian specimens I give below a table of measurements of two equal-sized specimens, one from Siam and the other from Calcutta (fig. 5).

Measurements in millimetres.

	Siam	Pulta, Calcutta
Total length	310·0	310·0
Length of caudal	58·0	56·0
Length of head	60·0	57·0
Width of head	31·2	31·2
Height of head	40·0	40·0
Diameter of eye	14·0	13·5
Length of snout	19·0	19·5
Interorbital distance	19·0	20·0
Width of body	20·0	29·0
Height of body	51·0	56·0
Length of nasal barbels	28·0	21·0
Length of maxillary barbels	30·0	21·5
Length of outer mandibular barbel... ...	28·0	21·0
Length of inner mandibular barbel ...	29·0	21·3
Length of pectoral spine	47·0	46·0
Least height of caudal peduncle	19·0	24·0

A comparison of the measurements distinctly shows that in the Siamese specimen the head, the pectoral spine and the caudal fin are longer, the barbels are relatively much longer and the eye is larger; but the body is very slender, both in height and in width.

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There are in the collection before me two other specimens of equal length, one from the Myitkyina District, Upper Burma and the other from Beas in the Punjab. A table of their measurements is given below.

Measurements in millimetres.

	Myitkyina	Beas
Total length excluding caudal	220·0	220·0
Length of head	46·0	44·0
Height of head	34·0	35·0
Width of head	25·0	27·0
Width of body	18·0	24·0
Height of body	49·0	53·0
Diameter of eye	12·0	11·5
Interorbital width	17·0	18·0
Length of snout	16·0	16·0
Length of nasal barbel	29·0	18·0
Length of maxillary barbel	31·5	20·0
Length of outer mandibular barbel	22·0	19·3
Length of inner mandibular barbel	24·0	22·0
Length of pectoral spine	40·0	38·0
Least height of caudal peduncle	19·0	21·0

Here again, we find the same differences between the Punjab specimens and the Burmese specimens as are noticed above between the Siam and the Pulta specimens. Further, it has to be noted that in the Siamese and Burmese examples the ventral fins are situated opposite the dorsal, whereas in the Indian specimens the dorsal is in advance of the ventrals.

Bionomics and Fishing Notes.

Thomas (**23**), who was chiefly familiar with the South Indian forms, makes no reference to *Eutropiichthys vacha*, though he gives an account of *Garua Butchwa*. Lacy (**16**) gives a general account of *Butchwa* and indicates that it 'belongs to two genera, *Eutropiichthys, Pseudeutropius*'. I think, however, that he is mainly dealing with the latter and not with the true *Bāchchā*, for *Eutropiichthys* is not so common in the Punjab rivers as *Clupisoma*. Dhu (**10**) also gives short notes on *Batchwa* or *Butchwa* but he makes no distinction between *Eutropiichthys* and *Pseudeutropius* (including *Clupisoma*) and recognises 'several species of Butchwa in India, *P. garua* (and *P. murius* the cherki) being probably the best known'. The following quotation from Dhu will show the great confusion that centres round the application of the name *Butchwa*:

'There are some seven species of this fish in India. Lately a certain amount of controversy seems to have arisen as to what name Pseudeutropius Garua—undoubtedly the most sporting member of the family—should go by. T. P. Luscombe—of the Tackle makers of that name at Allahabad—, whose knowledge of Indian angling is very extensive, calls "Garua" the Baikiri and "Vacha" the Butchwa. And he states:—"Garua" is a surface feeder—good

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eating—and generally of a blue and white colour with a large gaping mouth with an upward slant. "Vacha" is a bottom feeder of a light sea green in colour, has four barbels on mouth, which is rather small and round, and not a nice fish to eat."—Here we have more than one Richmond in the field! I do not know on what authority Luscombe fixes the names. I have referred the matter to more than one reputed ichthyologist, but can get no one to take the responsibility of making a definite statement on the subject! Day, our greatest authority on Indian fish, gives as vernacular names:—"Butchwa" and "Nandi Butchwa" for E. Vacha, and calls P. Garua "Poonia Butchwa". That the two fish may be caught in the same waters, and that confusion is liable to arise, the notes on Narora, of Captain Tate, bear out. However until the matter is definitely settled, I let the name stand, as the Butchwa is so familiar a name to many anglers in this country, and so long as fishermen realise that other low class relations may lay claim to the title of Butchwa or Baikiri, they are sufficiently safeguarded in describing their catches.

'He is a game little fish running up to 2 lbs. in weight, who will take either fly (lake trout size) or small spoon.

'He is only to be found in the rivers of Northern India. One excellent thing about him is that he will take in coloured water, in fact the time to fish for them is between March and November, when Mahseer fishing is out of the question. They have small teeth which cut one's gut occasionally, so examine your snoods from time to time.'

From an angler's point of view it seems highly desirable to clear the confusion about the popular nomenclature of the species, and for this purpose we cannot do better than to refer to the original sources. Hamilton (13) who introduced *Eutropiichthys vacha* in scientific literature for the first time has left behind extensive manuscript notes on the fish and fisheries of the districts he visited. These notes were published by Day (7) and therein we find the following particulars about this fish.

Dinajpur District, p. 29—'Váchá, Pimelode, a fish about the size of a herring, and considered as very good by the natives.'

Rangpur District, p. 44—'The Váchá of Goálpárá, Calcutta and Dinájpur; the Kángon of Lakshmípur.'

Purniah District, p. 60—'Kátlá. This must be carefully distinguished from the Kátal of the Bengalis, at Calcutta, usually called Kātlā, which is a species of Cyprin, very common in Ganges and Mahánandá, but scarcely ever found in the Kusí.'

Bhagalpur District, p. 76—'The Bắchoyā is another Pimelode, called Váchá in Bengal, and Kátlá at Náthpur.'

Patna District, p. 88—'The Pimelodes called Bắchoyá at Monghir, at Patná is called Sữgwábắchoyá.'

In his description of the species Hamilton (13) notes:

'The *Vacha* is common in all the larger fresh water rivers of the Gangetic provinces, grows to about a foot in length, and is an excellent fish for the table.' The mouth is described as 'very large, and descends, with a little obliquity, from the extremities of the head below the eyes.'

The above observations leave no doubt about the identity of *Butchwa*, and from the nature of its mouth it can be readily distinguished from *Garua*.

Day also notes that it is good eating. According to Beavan (1), 'It rises readily to a fly, and affords good sport.'

Dhu (10) in his account of fishing at Narora (pp. 482-491) makes several references to *Butchwa*. Writing of pools below the falls he says (p. 484):

'There, too, morning and evening when the Butchwa are on the feed, which will soon be apparent by the water seeming to boil as they chase

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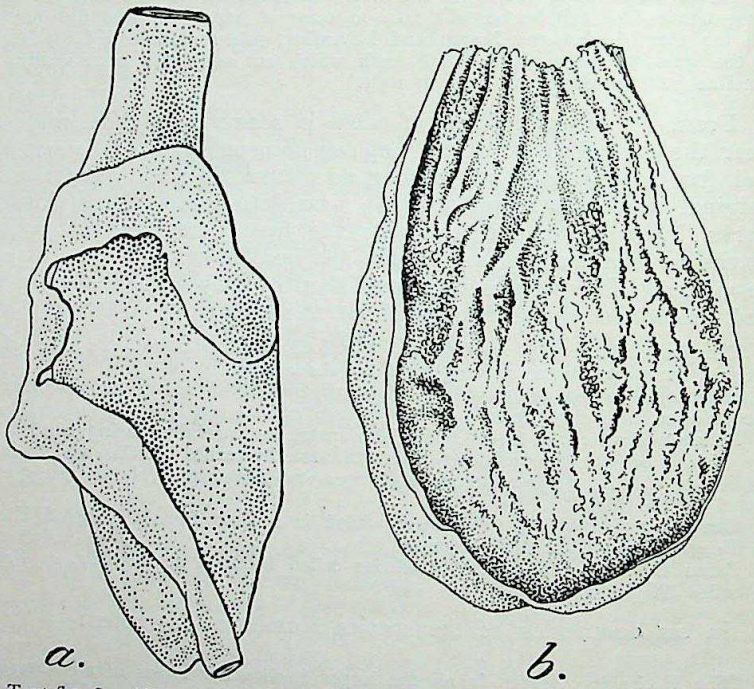
and scatter the fry, very good bags may be made by using a fly-spoon or a fly (lake trout or small salmon size). If the near or far gates are shut down, and you can get along the top of the fall, and mount on to one of the aforementioned piers, this is an excellent place to fish from, and very pretty sport may be had with the Butchwa and trout, especially the latter, using a light rod and fly-spoon . . . And catching Butchwa and Barilius bola thus side by side, one is able to make a very fair comparison of the two fish, and there is no doubt that weight for weight the trout puts up the finer fight. But from an edible point of view he is a very bad second. Using a lake trout size fly is really the best sport, as the fish take it greedily, and thus lightly hooked made a great fight of it.'

In the form of its body and the large ascending mouth *Bāchchā* corresponds with the 'Indian Trout', and from the above it seems that it can be fished with the type of tackle ordinarily used for fishing *Barilius bola* (Ham.).



Text-fig. 8. Alimentary canal of *Eutropiichthys vacha* (Ham.) ×1½.
a. The whole of the alimentary canal; *b*. The stomach cut open to show the nature of its internal wall.

It is a very voracious fish and mainly feeds on other smaller fish or insects. Its alimentary canal is short and the stomach is very capacious. The walls of the stomach are raised into longitudinal folds.

In the river Hooghly boat-loads of *Bāchchā* and *Garua* were found about 40 miles above Calcutta. The two species occurred in almost equal numbers, and both were found by experience to be good eating. It seems that in nature the two species do not compete for food; the former feeds near the surface while the

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latter feeds near the bottom. From the abundance of both types of fish in the *Kachha* settling tanks of the Calcutta Corporation Water Works at Pulta it seems certain that the fish can be acclimatised to lakes, large tanks and bheels. The food is so plentiful in the Corporation tanks that the largest specimen I have seen, about 16 inches in total length, was captured from there. These tanks get a continuous supply of fry of all kinds from the water of the river that is pumped into them, but in ordinary tanks *Eutropiichthys* may prove very destructive to other smaller fish, and, therefore, its culture cannot be recommended.

Ordinarily *Bāchchā* grows to about a foot in length and attains a weight of about a couple of pounds. Prashad and Mukerji (18) state that 'It is said to inhabit the deeper parts and to grow to a weight of about 30 lbs.' It seems unlikely, however, that the fish attains this weight in Burma. The largest specimen they had was about 13 inches in total length.

Acknowledgments.

The Bombay Natural History Society very kindly made a grant towards the cost of illustrations and for this I have to offer my sincere thanks to the authorities of the Society. Mr. K. S. Misra, M.SC., my assistant in the Zoological Survey of India, has helped me in the preparation of the tables of measurements and for this I am very grateful to him. The illustrations were prepared by Babu B. Bagchi, with his usual skill and care.

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Explanation of Plate.

Lateral view of a Chittagong specimen of *Eutropiichthys vacha* (Hamilton). × *ca.* $\frac{3}{4}$.

The specimen and a rough colour sketch were supplied by the late Babu A. C. Chowdhary, a retired artist of the Zoological Survey of India.

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THE VERNAY SCIENTIFIC SURVEY OF THE EASTERN GHATS.

(Ornithological Section).

BY

Hugh Whistler, M.B.O.U., assisted by N. B. Kinnear, M.B.O.U.

Part XVI.

(*Concluded from page* 263 *of vol.* xxxix).

Pelecanus onocrotalus Linnaeus.

Pelecanus onocrotalus Linnaeus, Syst. Nat. ed. x, vol. i (1758), p. 132—Caspian Sea.

There is very little evidence as to the occurrence of the Roseate Pelican within our limits and it usually rests on a specimen from 'Madras' (Jerdon) in the British Museum. This however may now be supplemented by the sight record[1] of two birds in the backwater of Vizagapatam in October 1923, and a specimen seen and later obtained at Konda-Kerla, a lake 18 miles south of Vizagapatam (Law, *J.B.N.H.S.*, xxx, 483).

The student is reminded that Captain C. H. T. Grant has pointed out that this species cannot properly be divided into two races either on size or number of tail-feathers, the alleged differences being doubtless due to age and individual variation. He has also shown that the name *Pelecanus roseus* of Gmelin belongs rightly not to the Roseate Pelican but to the Spot-billed Pelican (*Bull. B.O.C.*, vol. lv, 1935, p. 63).

The Pelicans and the remaining birds on our list are practically unrepresented by any fresh material in the Survey. I have therefore not made any original investigations into the races of the species that follow and merely accept the races and names as given in the *New Fauna*.

Pelecanus roseus Gmelin.

Pelecanus roseus Gmelin, Syst. Nat. vol. i, pt. 2 (1789), p. 570—Manilla, Luzon, Philippine Islands.

Jerdon informs us (*B. of I.*, iii, p. 860) that he visited one colony of the Grey or Spot-billed Pelican in the Carnatic where the birds had for ages, according to his informants, built on low trees in the middle of a village, caring little for the close and constant proximity of human beings. The comment in the *Old Fauna* (iv, 336) that there was no late authentic account of Pelicans breeding in India led to the appearance in the *Journal* of two fresh records. In vol. xiv, p. 401 Howard Campbell described how in March 1890 in a secluded valley in the extreme east of the Cuddapah district he had found several hundreds of nests on neem and tamarind trees in a small village called Buchupalle. The nests all apparently contained young.

A second colony was described by C. E. Rhenius (*J.B.N.H.S.*, xvii, 806) at Kundakolam in the Nunguneri Taluq of the extreme south of the Tinnevelly district. On 8 June the nests all contained young, including many birds able to fly.

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[1] It will be remembered that the identity of the Pelicans occurring in the Presidency is based almost entirely on sight records which can hardly be considered satisfactory.

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In both these colonies the birds were breeding in association with the Painted Stork (*Ibis leucocephalus*) and were strictly protected by the villagers.

The only other information I can trace about the Spot-billed Pelican in the Presidency is a specimen from Tada, Nellore District, said to be in the Madras Museum and Ferguson's statement that it occurs in S. Travancore where he once saw three flying over the parade ground in Trivandrum.[1]

Phalacrocorax carbo sinensis (Shaw).

Pelecanus sinensis Shaw, Nat. Misc., xiii (1801), pl. 529 text—China.

The Cormorant is said by Annandale[1] (*Rec. Ind. Mus.*, xxii, 328) to visit Barkuda Island on the Chilka Lake occasionally.

Terry (apud Hume *N.* & *E.*, iii, p. 271) describes the nesting of the cormorant on a large tank some thirty or forty miles from Bellary near the Madras railway. Some six or seven pairs were nesting on some small rocks in the centre of the tank and had both eggs and young on 17th January.

Major Bates informs me that he could only find two pairs breeding in the famous heronry of Veden Thangul described in Hume's *N.* & *E.*, iii, p. 238 (*rectius* Vedan Thangal near Pudupattu).

An account of their nests will be found in Bates' *Bird Life in India*, p. 37. In 1928 a female was brooding chicks on December 20th and these were nearly ready to fly on January 13th. In 1929 the nests contained eggs on December 29th and the young were still in down on February 16th.

Jerdon's statement that he had seen it on the 'wooded Bhowany' at the foot of the Nilgiris complete the records for the Presidency. No Presidency specimens are available for examination.[2]

Phalacrocorax fuscicollis Stephens.

Phalacrocorax fuscicollis Stephens in Shaw's General Zool., vol. xiii, pt. I (1826), p. 91—Bengal.

Very large numbers of the Indian Shag are to be found on the Chilka Lake according to Annandale (*Records Ind. Mus.*, vol. xxii, pt. iv, No. 23 (1921), p. 328. It breeds in enormous numbers on Kalidai, the sacred island, and the young birds are nearly fledged by the end of October.

There is a specimen from Tada, Nellore District in the Madras Museum and according to Finn some are to be seen on the Red Hills tank near Madras. Captain Packard found them breeding in numbers at the Vedan Thangal tank on December 1st, on which date there were eggs (*J.B.N.H.S.*, xv, 138).

Jerdon's statement that he procured the Indian Shag in the Carnatic completes my information from the Presidency and I have seen no specimens from there.

Phalacrocorax niger (Vieillot).

Hydrocorax niger Vieillot, Nouv. Dist. Hist. Nat., nouv. éd., vol. viii (1817), p. 88—East Indies = Bengal.

The Pygmy Cormorant is found on the Chilka Lake (Annandale, *Records Ind. Mus.*, xxii, 328). There is a specimen from Tada, Nellore District, in the Madras Museum and Dewar says that it is abundant on most of the large sheets of water round about Madras.

In the Vedan Thangal Heronry the Pygmy Cormorant breeds in great numbers and a good account of it there will be found in Bates' *Bird Life in India*,

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[1] It will be remembered that in the Madras Presidency, although a certain amount of rain falls at odd times throughout the year, it is only after the breaking of the North-east monsoon that water collects in the numerous tanks constructed for irrigation of the rice fields and gives the signal for the breeding of the various Pelicans, Storks, Herons, Ibises etc. The monsoon may break towards the end of September or not until late October or even early November. The nidification of these birds may consequently be in very different stages on any particular date in two consecutive years.

[2] In the water birds that follow I have included these records of the Chilka Lake as it borders on the Presidency and must throw light on conditions in the northern Circars.

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pp. 20-47. In a private note that he gave me Major Bates estimated that in 1928 and 1929 the Pygmy Cormorants composed about two-thirds of the total population of the colony which was not under 5,000 birds. In 1928 most of the nests on December 20 contained young ones in all stages of growth, though the largest were still in down. In 1929 on December 29th very few eggs were even hatched.

On the western side of the Presidency William Davison thought he saw a party flying high overhead in the evening at Manantoddy and Ferguson states that he had seen it on the tanks and lakes in and about Nagercoil.

There are three specimens labelled 'Madras' without proper date in the British Museum.

Anhinga melanogaster Pennant.

Anhinga melanogaster Pennant, Indian Zool. (1769), p. 13, pl. 12—Ceylon and Java.

According to Annandale (*Records Ind. Mus.*, xxii, 328) the Indian Darter is not uncommon on the Chilka Lake and Jerdon calls it not very uncommon in the Northern Circars. Dewar includes it in his Madras list without comment and there is a female from Madras in the British Museum collected on June 9th by Wardlaw Ramsay as well as a specimen from Chingleput in the Madras Museum. In the Vedan Thangal Herony Bates (*Bird Life in India*, p. 39) found it scarce, only about half a dozen pairs being found there in both years. Newly hatched young were noted on 7 February 1929. Hume says (*N. & E.*, iii, 274) that in the country south of Madras this species lays in January or February.

On the western side we have William Davison's statement that he obtained the Darter on the Pykara river about 9 miles from Ootacamund and that he had also noticed it in the Wynaad. Mr. Betts informs me that he also saw a single bird on the Pykara river on several occasions, spread over three years. It was always on the same stretch of water. In Travancore, according to Ferguson, it is common on all the larger fresh water lakes. It is abundant on the lake formed by the Peryár dam at 3,000 ft. in the hills and equally common on the Sastancotta lake in the low country. Bourdillon describes a colony found nesting about the Athirapuzha fall of the Kodasheri river in September.

Sula leucogaster plotus (Forster).

Pelecanus plotus Forster, Descr. Anim. (ed. Licht.), 1844, p. 278—Near New Caledonia.

Under the name of *Sula fiber* Jerdon states that he received a specimen of the Booby from the Malabar coast, but this specimen is no longer in existence. The record may, however, be accepted as this bird has been obtained on several occasions on the coast of Ceylon.

Sula dactylatra melanops Heuglin.

Sula melanops Heuglin Isis, 1859, p. 351, pl. x, figs. 1 and 2—Burda Rebshi, Somali coast.

The occurrence of the Masked Booby on the Presidency coast rests on a young female which was obtained by Colonel H. R. Baker at Cannanore on 19 July 1911 (*J.B.N.H.S.*, xxi, 272). It was found sitting on the cliff and was killed by a servant with a stick, its occurrence being doubtless due to 'the heavy gales we have experienced lately.' This specimen is now in my own collection and I have compared it at the British Museum. It is in immature plumage and there is no specimen in quite the same stage in the British Museum but I think it may be correctly attributed to the above race. This record was overlooked by the *New Fauna*.

Fregata andrewsi Mathews.

Fregata andrewsi Mathews, Austr. Av. Rec. vol. ii (1914), p. 120—Christmas Island, Indian Ocean.

Jerdon long ago stated (*B. of. I.*, iii, 853) that he had received a specimen of the Frigate-bird, 'in young plumage' which was shot on the Malabar coast

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off Mangalore. He recorded it as *Attigen aquilus* but as he then only recognised two species, the actual identity of his specimen remains in doubt.

In *J.B.N.H.S.*, xxxiii, 445, Mr. Prater, however, records a specimen of this species presented to the Society by Mr. L. A. Lampard. It was caught in a fishing net in a rough sea at the onset of the monsoon off the coast of Quilon, Travancore.

Fregata ariel (G. R. Gray).

Atagen ariel G. R. Gray, Genera Birds, vol. iii (1845), col. pl. 183—Raine Island fixed as type locality by Mathews [Birds of Australia, vol. iii (1914), p. 285].

Ferguson states that an immature specimen of the Smaller Frigate-bird was taken at Perumathoray about 10 miles from Trivandrum and brought to him alive (*J.B.N.H.S.*, xvi, 13).

[Puffinus

There can be little doubt that various species of Petrels and Shearwaters occur off the coasts of the Madras Presidency but there are as yet only three records and the exact species to which they refer are as yet unknown.

The best known record is that of Jerdon *Birds of India*, vol. iii, p. 826—'Two species of Petrel have been observed by myself, of only one of which I obtained a specimen, from the neighbourhood of Madras, where I had, on several occasions, observed it not far from the shore, during rather rough weather; I lost this, however, before an accurate description was taken, and I can only say that I suspect it belongs to the Division *Æstrelateæ*, of Bonaparte and probably to the Genus *Petrodroma*, Bonap.: indeed, it appeared to be very similar to *P. macroptera* of Dr. A. Smith, figd. in Zool. South Africa, Birds, pl. 50. It was entirely of a dull sooty-brown colour, palest beneath; length nearly 18 in.; wing 12½; tail 5; bill at gape nearly 1¾ in. In the *Old Fauna* this was doubtfully identified as *Puffinus chlororhynchus*.

Blanford in the *Old Fauna* (iv. 358) remembered when on his way from Calcutta to Madras by steamer in 1867, seeing several small petrels (apparently without white rumps) only a few yards away from the vessel. They were probably of the genus *Oceanodroma*.

Finally Ferguson (*J.B.N.H.S.*, xvi, 14) says that a single specimen of a Shearwater, which he calls *Puffinus persicus*, was taken at Valey, 4 miles from Trivandrum, and brought to him alive.

Observers at the ports of the Presidency are urged to make an endeavour to secure such specimens of these birds as may be caught by fishermen out at sea. It must however be realised that the correct identification of these birds is a matter of great difficulty and care should be taken to have any specimens procured examined by a competent authority on the group.]

Daption capense (Linnaeus).

Procellaria capensis Linnaeus, Syst. Nat. ed. x, vol. i (1758), p. 132—Cape Seas.

The Cape Pigeon may be by courtesy included in the Presidency list as a straggler. Hume received through Mr. H. R. P. Carter from Mr. Theobald a specimen killed between Ceylon and the main land in the Gulf of Manaar. It is now in the British Museum (*Ibis*, 1870, p. 438 and *S.F.*, vii, 463).

Platalea leucorodia Linnaeus.

Platalea leucorodia Linnaeus, Syst. Nat. ed. x, vol. i (1758), p. 139—Europe.

The Spoonbill appears to have been recorded only from the Eastern side of the Presidency and even from there I have seen no specimens.

Mr. D. Hatchell found a nest with young amongst rushes in the Kolair Lake (*Birds of S. India*, p. 438) and this is of special interest in view of the statement in *Nidification*, iv, 435 that the nesting in reeds of this species has not yet been recorded in India.

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According to Dewar the Spoonbill is not common in the neighbourhood of Madras but there is a specimen from Pulicat in the Madras Museum.

The Spoonbill was not included in the list of species breeding at Vedan Thangal as furnished to Hume (*N.* & *E.*, iii, 238). Bates, however, in *Bird Life in India*, p. 41, estimates the number of Spoonbills at the colony as not less than 300 or 400 pairs and says that they were on the whole the latest birds nesting, which perhaps explains their absence from the earlier account. In 1929 the majority of their eggs were only just hatching on February 7 and in the following season (1929-1930) only two nests were found to contain eggs by December 29th and no eggs had hatched by February 16th.

Threskiornis melanocephala (Latham).

Tantalus melanocephalus Latham, Ind. Orn., ii (1790), p. 709—India.

The White Ibis is not uncommon on the Chilka Lake according to Annandale (*Records Ind. Mus.*, xxii, 329), but I can trace no other record of it on the eastern side of the Presidency except at Vedan Thangal, where Hume's correspondent (*N.* & *E.*, iii, 238) implied that it was one of the common species in that Heronry. It was not one of the five species present when Captain Packard visited Vedan Thangal in 1902 (*J.B.N.H.S.*, xv, 138). However Major Bates found it in both seasons 1928-1929 and 1929-1930. The first season he estimated that about ten pairs were present and there were eggs in some nests on December 20th, the young being able to clamber about the branches of the trees by February 7th. In the season 1929-1930 the number were estimated at about 60 or 70 pairs. Most of the nests had eggs on December 29th, though two were found with newly hatched young. In other words, Bates points out, nidification was at the same stage in both years with this species, which was not the case with any other species at the colony (*Bird Life in India*, p. 39).

In Travancore Ferguson says he has only seen the White Ibis in the cold weather at Sastancotta and doubts whether it is a resident in the State. They feed by day in the paddy fields and are difficult to approach, but generally roost in trees on the banks of the lake.

No specimens are available for examination.

Pseudibis papillosa (Temm. and Lang.).

Ibis papillosa Temm. and Lang. Planch. color. d'ois. livr. 51 (23 October 1824), pl. 304—no locality (India).

Mr. Hatchell of the Madras Survey Deptartment reports having shot a couple of Black Ibis out of a flock of eight at Peddangopavaram in the Nellore District in November 1902 (*Birds of S. India*, p. 440). Otherwise the bird is recorded in the Presidency only from the Wynaad where William Davison says he found flocks frequenting the trees bordering the banks of the river at Manantoddy in April 1881. They were exceedingly noisy and Davison thought they were preparing to breed.

Plegadis falcinellus (Linnaeus).

Tantalus falcinellus Linnaeus, Syst. Nat., ed. xii (1766), p. 241—Austria and Italy.

The only records that I know of the Glossy Ibis in the Presidency are furnished by three specimens in the British Museum, namely a male and female from 'Madras' and a female from Coimbatore, October 31. All of these are in the Hume collection.

Ciconia ciconia (Linnaeus).

Ardea ciconia Linnaeus, Syst. Nat. ed. x, vol. i (January 1758), p. 142—Sweden.

There is very little information about the White Stork in the Presidency. Law (*J.B.N.H.S.*, xxx, p. 483) mentions seeing a group of about half a dozen resting by a channel of the Vizagapatam backwater in October 1923.

On the western side two were obtained from a shikari by Mr. G. A. R. Dawson of Coonoor (*S.F.*, x, 415) in October 1870. They were said to have

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been shot from a flock of 18 which were feeding on open grassland near the sandy vale between Ootacamund and Pykara.

Dissoura episcopus episcopus (Boddaert).

Ardea episcopus Boddaert, Table Pl. Enlum. (1783), p. 54 for Pl. Enl. 906—Coromandel coast.

The White-necked Stork occurs on the Chilka Lake according to Annandale (*Records Ind. Mus.*, xxii, 329). Dewar includes it in his Madras list without comment and Colonel H. R. Baker (*Birds of S. India*, p. 445) says he has seen it in flocks on the shallow tanks outside Trichinopoly and in the paddy fields near the river which runs parallel to the railway between Shoranur and Calicut. William Davison saw a pair on a dead tree on the river bank at Manantoddy, Wynaad. Colonel Baker shot a female on 21 December 1921 in a swamp on the top of the Sigur Ghat near Ootacamund but this appears to be the only record for the Nilgiris. This specimen is now in my collection.

In Travancore Ferguson had information of only two specimens. One was obtained on the banks of the river at Palode. The other was brought in alive, taken on the bank of a tank near Nagercoil.

There is nothing to show the status of the White-necked Stork in the Presidency.

Xenorhynchus asiaticus asiaticus (Latham).

Mycteria asiatica Latham, Ind. Orn. vol. ii (1790), p. 670—India.

According to Annandale (*Rec. Ind. Mus.* xxii, 329) the Black-necked Stork occurs on the Chilka Lake. Otherwise there is no record of its occurrence in the Presidency beyond Dewar's inclusion of it, without comment, in his Madras list.

Leptoptilos javanicus (Horsfield).

Ciconia javanica Horsfield, Trans. Linn. Society, vol. xiii, pt. i, May 1821), p. 188—Java.

The Lesser Adjutant is confined in the Presidency to the south-west where Ferguson says it is by no means common, but may be found about the tanks in South Travancore. Live specimens were brought in to him for the Zoological gardens from time to time. No doubt it was this area that Jerdon had in mind when he said he had only seen it in Southern India on the Malabar coast. An immature bird from 'Madras' (Jerdon) is in the British Museum.

Ibis leucocephalus (Pennant).

Tantalus leucocephalus Pennant, Ind. Zool. (1769), p. 11, pl. 10—Ceylon.

The Painted Stork is recorded only from the Eastern side of the Presidency. Ball (*S. F.*, v, 420) says that he not infrequently saw flocks on the Jaipur (Jeypore) plateau. Howard Campbell found large numbers breeding with Pelicans in a secluded valley in the extreme east of the Cuddapah district in a small village called Buchupalle. This was in 1890 and at the end of March all the nests contained young though he found one clutch of hard set eggs (*J.B.N.H.S.*, xiv, 401).

There is some mistake about the statement (*Nidification*, iv, 450) that Bates found this species breeding near Madras. He did not do so and it has not been recorded in the Vedan Thangal Heronry.

Finally Mr. C. E. Rhenius (*J.B.N.H.S.*, xvii, 806) found another large colony, again breeding with Pelicans, in the extreme south of the Tinnevelly district. This was at Kundakolam in the Nunguneri Taluq. On 8 June there were young in various stages of development.

Anastomus oscitans (Boddaert.).

Ardea oscitans Boddaert, Table Pl. Enlum, p. 55 (1783) for Pl. Enl. 932—Pondicherry, India.

Mr. D. Hatchell states that the Open-bill is common in the Nellore District (*Birds of S. India*, p. 448).

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Our main information about this curious bird in the Madras district, however, comes from the Vedan Thangal Heronry where the first account of its nesting was published in Hume's Rough Draft in 1873. It will be remembered that Major Bates was able to trace by documentary evidences the existence of this Heronry as far back as the years 1796-1798 (*Bird Life in India*, p. 29).

In 1903 the Heronry was again described by Captain H. N. Packard (*J.B.N.H.S.*, xv, p. 138) who visited it on December 1st 1902. On that date the eggs of the Open-bill were in all stages of incubation and the adults without exception were all in the grey plumage (a statement that suggests that the *New Fauna*, vi, p. 333 is wrong in calling this the non-breeding plumage).

Bates visited the Heronry again in the seasons 1928-1929 and 1929-1930. The first winter all the Open-bills had young on December 20th, some being sufficiently old to look capable of flight by December 29th. Numbers were actually on the wing by January 13.

In 1929-1930 the very largest young were not as large as chickens by December 29th. These were capable of flight by February 16th but on that date newer arrivals in the colony were still only laying eggs. The total number of adults at the colony this season were estimated by Baker as about 200 birds in all.

Where these birds spend the non-breeding season is not clear unless it is in Travancore. Bates, however, on three separate occasions—viz. 5 March 1924, 29 March 1929 and the very end of April 1930—saw birds flying over St. Thomas' Mount and these he presumed were birds leaving the Heronry.

In Travancore, according to Ferguson, the Open-bill is very common and large flocks may be met with on the marshy borders of all the larger tanks and fresh water lakes. He did not, however, find any evidence of breeding.

Ardea purpurea manilensis Meyen.

Ardea purpurea var. *manilensis* Meyen, Nova Acta Acad. Leop. Carol., vol. xvi, Suppl. (1834), p. 102—Philippines.

The Purple Heron is no doubt very generally distributed in the Presidency. Mr. Hatchell reports specimens shot at Bhimadole in the Godaveri District, at the Nagathur canal, Kurnool District, and at Dharmapuri, Salem District (*Birds of S. India*, p. 450). It occurs without comment in Dewar's Madras list and Captain Packard (*J.B.N.H.S.*, xv, 139) found it breeding at Vedan Thangal on December 1st 1902. He then estimated that perhaps 8 or 10 pairs were present in the Heronry—this species usually nests in reed beds—though they were so shy that he had great difficulty in identifying their nests and only managed to satisfy himself in one case. None appear to have been found by Bates on his visits to this colony.

On the western side the country is less suitable for the Purple Heron but Hume received a specimen for identification shot somewhere about the base of the Nilgiris (*S.F.*, x, 416). In Bourdillon's time it was abundant at the Vellarney Lake 7 miles from Trivandrum whence there is a female (June 21, Bourdillon) in the British Museum. When Ferguson wrote however the reeds had gone and with them of course this species, which however he shot at Sastancotta. In Travancore according to Bourdillon and Ferguson, the breeding season was in July and August (Stuart-Baker, *Nidification*, iv, 456).

Ardea cinerea rectirostris Gould.

Ardea rectirostris Gould, P.Z.S., 1843, p. 22—New South Wales.

The Heron is common on the Chilka Lake according to Annandale (*Rec. Ind. Mus.*, xxii, 329) and it breeds there on some of the islands in September. Dewar includes it in his Madras list without comment.

This species breeds at the Vedan Thangal Heronry and is mentioned there before 1873 by Hume's anonymous correspondent, though without any particular details being vouchsafed. Packard evidently found it common at the Heronry and eggs were hatching on December 1st (*J.B.N.H.S.*, xv, 139). Bates also found the Herons numerous and considered them the earliest of the breeders in the colony. All—but a few stragglers—had finished and left by the end of February in the season 1928-1929. Next season he noted that many eggs had hatched and a few young were already feathering by December 29.

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On the western side our only information is from Ferguson who says that in Travancore the Heron frequents the backwaters along the coast but is not found in the interior. A captive bird in the Public Gardens had lived for over 17 years! There is a Travancore skin (Bourdillon: no data) in the British Museum.

Egretta alba modesta (Gray).

Ardea modesta Gray, Zool. Misc. (19 February 1831), p. 19—India.

The Great White Heron is found on the Chilka Lake according to Annandale (*Records, Ind. Mus.*, xxii, 329) and Dewar includes it without comment in his Madras list, but I do not find any other record of this species from the Eastern side of the Presidency. The original account of the Vedan Thangal Heronry appears under this species in Hume's Rough Draft (p. 614) and is copied again under it in Stuart Baker's Nidification (iv, 459). It will be noted, however, that the name of this species—as distinct from other Egrets—does not actually occur in the account and Bates appears to have found only the Little Egret at the colony.

On the western side the Great White Heron is only recorded from Travancore whence there is a skin from Kolachul (January, Bourdillon) in the British Museum. Ferguson says that this Heron is by no means common and very wary. At Sastancotta it roosts in company on the trees round the lake.

Egretta intermedia intermedia (Wagler).

Ardea intermedia Wagler, Isis (1829), col. 659—Java.

Annandale implies that the Smaller Egret is not uncommon on the Chilka Lake (*Rec. Ind. Mus.*, xxii, 329) and Dewar includes it in his Madras list without comment. Otherwise it is recorded in the Presidency only from Travancore where Ferguson says it is fairly common about the edges of the backwaters and lakes from Quilon northwards. It is usually seen in companies of 3 or 4 or even more, but is not nearly so abundant in the South.

I do not know the evidence on which Stuart Baker (*New Fauna*, vi, 347) says that 'in Madras and the south they breed during December and January'.

Egretta garzetta garzetta (Linnaeus).

Ardea garzetta Linnaeus, Syst. Nat., ed. xii (1766), vol. i, p. 237—'In Oriente' =Malalbergo, N.E. Italy.[1]

The Little Egret, also, is recorded from the Chilka Lake by Annandale who implies that it is common, while it is included in Dewar's Madras list without comment. It is the common Egret of the Vedan Thangal Heronry and Bates informs me that there were not less than 500 birds standing round the margins of the tank at each of his visits. How many of these birds actually breed in the Heronry is a problem. Packard did not include it in his list of the breeding species. Bates considers that if the Egrets breed at the Heronry at all they do so late in the season, as certainly only a dozen or less were breeding there by early March 1929 while on 16 February 1930 there were only two pairs nesting, one still building, the other still laying. They were certainly not nesting earlier in the season and he has some doubt as to whether they had then even assumed breeding plumage.

In Travancore according to Ferguson the Little Egret is not uncommon about the backwaters of the coast, going about solitary or in pairs.

Bubulcus ibis coromandus (Boddaert).

Cancroma coromanda Boddaert, Table Pl. Enl. (1783), p. 54 for Pl. Enl. 910—Coromandel, India.

The only information that I can trace regarding the Cattle Egret on the eastern side of the Presidency is its inclusion in Dewar's Madras list (doubtless on the strength of the specimen in the Madras Museum) and the statement in the *Old Fauna* (iv, 389)—whose provenance I cannot trace—that the breeding season in the Carnatic is in November and December.

[1] See Grant, *Bull., B.O.C.*, liii (1933), p. 194.

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On the west Fairbank includes it in his Palni list as observed following cattle near the base of the hills. In Travancore Ferguson says that it is far the commonest of the White Egrets, being found in numbers in all paddy fields throughout Travancore along the backwaters and in cultivated lands. He says the breeding plumage is assumed about April. There are an Anjango specimen and another (♀ 13 November, Bourdillon) from Trivandrum in the British Museum.

Demiegretta asha (Sykes).

Ardea asha Sykes, *P.Z.S.*, 1832 (22 November), p. 157—Dukhun.

Very little is known about the Indian Reef-Heron in the Presidency. Colonel H. R. Baker (*B. of S. India*, p. 455) says that he met with it at Cannanore and that Mr. Hatchell records obtaining a possible specimen near Ellore. Ferguson's collectors obtained a single specimen at Ayrentenga, on the coast near Kayankulum in Travancore. There is an old specimen in the British Museum, said to have been obtained by Sykes in the Tinnevelly district and formerly in the India Museum. The status in the Presidency is therefore quite unknown.

Ardeola grayii (Sykes).

Ardea grayii Sykes *P.Z.S.*, 1832 (November 22), p. 158—Dukhun.
Specimen collected :—1739 28-4-30 Anantagiri 3,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1 ♂	70.5	213	78	60 mm.

The Pond-Heron is common on the Chilka Lake according to Annandale (*Records Ind. Mus.*, xxii, 329) and LaPersonne reports, in reference to the above specimen, that at Anantagiri they were found to frequent the hill streams. On this side there is no other information beyond Dewar's inclusion of it without comment in his Madras list.

On the west there is more to set forth. In Coorg Betts says it is widely distributed wherever there are paddy fields, ponds or swamps. In the Wynaad William Davison considered it common and his note on it in the Nilgiris is of interest—'Some years ago this species was rare on the Nilghiris, a few occurring during the cold weather about the lake at Ootacamund, but within the last three or four years it has become quite numerous about the marshy banks of the lake. I counted thirty in the course of a walk one morning. It is, however, only a cold weather visitor to the Nilghiris, disappearing as the breeding season approaches'. According to Colonel H. R. Baker (*B. of S. India*, p. 456) it still occasionally occurs in winter at Ootacamund though I believe one of the lakes has been drained.

In the Palnis both Fairbank and Terry record it, by streams and ponds at the base of the hills according to the former and very abundant in all parts of the district according to the latter. As to Travancore Ferguson states succinctly that it is one of the commonest and most familiar birds throughout the whole country.

The breeding season in the Presidency does not appear to have been recorded.

No proper material is available from the Presidency to verify that South Indian birds are the same as those from Northern India.

Butorides striatus javanicus (Horsfield).

Ardea javanica Horsfield, Trans. Linn. Society, vol. xiii, pt. i (1821 May), p. 190—Java.

The occurrence of the Little Green Heron has not been substantiated on the eastern side of the Presidency beyond the fact that a local specimen in the Madras Museum is apparently the basis for its inclusion in Dewar's Madras list.

On the west William Davison says that he met it on several occasions in the Wynaad but it apparently does not ascend the Nilgiris. Kinloch identified it in the Nelliampathies (*J.B.N.H.S.*, xxvii, 943).

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In Travancore it is believed to be a winter visitor only. Bourdillon said that it was to be found from November to March among the rocks of the larger streams up to about 2,000 ft., always in dense jungle. Ferguson said that it was common in the low country from November to April. There are two specimens from Bourdillon in the British Museum. One has no precise data. The other was collected at Merchiston on March 27th.

Nycticorax nycticorax nycticorax (Linnaeus).

Ardea nycticorax Linnaeus, Syst. Nat. ed. x, vol. i (1758), p. 142—South Europe.

According to Annandale (*Records Ind. Mus.*, xxii, 329) the Night Heron is common and breeds on the Chilka Lake. Dewar records a considerable colony on the Red Hills tank near Madras and these birds breed on the islands in the middle of the tank. They were visited on 3 September and most of the young birds were then fledged, though one or two nests still held eggs.

When Packard visited the Vedan Thangal Heronry on December 1st he found the Night Heron in thousands. Some were in very bedraggled plumage —which he attributed to their being engaged with second broods while the young of the first broods were still about the nests.

In the same Heronry Bates found the Night Heron one of the most abundant species, vying only with the cormorants in numbers. Their nidification appears to extend over a longer period than in the case of the other birds, for at his first visit on 20 December 1928 not only did the nests contain both eggs and young but a number of young birds were actually seen in flight. Yet on March 7th when many Night Herons had apparently departed there were still numbers of fresh eggs to be found.

Ferguson's collectors found the Night Heron fairly common at Perambulam in North Travancore and at other places round the Vembanad Lake. Otherwise I find no records from the west beyond Willam Davison's statement that he heard its call on several occasions in the Wynaad.

Gorsakius melanolophus melanolophus (Raffles).

Ardea melanolopha Raffles, Trans. Linn. Soc., vol. xiii, pt. 2 (November 1822), p. 326—Sumatra.

In the Presidency the Malay Bittern is confined to the western side and even here we do not know very much about it. There is a specimen from Coorg (Day) in the British Museum. Col. H. R. Baker shot a fine female on 31 October 1921 in a shola on the top of the Sigur Ghat 7,200 ft. near Ootacamund where it appeared to be a straggler (*J.B.N.H.S.*, xxviii, 547). This specimen is now in my own collection.

In Travancore it appears to be a resident. Bourdillon obtained a male at Invercauld 2,500 ft. on January 3rd 1878 which is now in the British Museum. Ferguson received two examples alive and Stewart is said to have obtained many nests (*Nidification*, iv, 479). He found the breeding season to be from the end of May to early July.

Ixobrychus sinensis sinensis (Gmelin).

Ardea sinensis Gmelin, Syst. Nat., vol. i, pt. ii (1789), p. 642—China.

According to Stuart Baker the Yellow Bittern is common and resident in Travancore and Malabar but the only original record that I can trace for this area is that by Ferguson whose collectors brought 'several specimens from North Travancore where it was found solitary on the banks of the backwaters about Kottayam and Vycome'. Two males and a female from Trivandrum (February) are in the British Museum as well as another specimen marked Madras, February, A. G. Theobald.

Ixobrychus cinnamomeus (Gmelin).

Ardea cinnamomea Gmelin, Syst. Nat., vol. i, pt. ii (1789), p. 643—China.

There are two specimens of the Chestnut Bittern from Coorg in the Tweeddale collection in the British Museum. Hume received two other specimens from the Wynaad (*S.F.*, x, 417). Jerdon (*Madras Journ. Lit. Sci.*,

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No.29, October 1840, p. 198) tells us that he saw it on the banks of the Pykara river in the Nilgiris. In Travancore, according to Ferguson, it is common on all the lakes and backwaters.

For the eastern side of the Presidency I have no information beyond the fact that Dr. Gravely kindly informs me that there is a local specimen in the Madras Museum.

There is nothing to shew the status of the Chestnut Bittern in the Presidency.

Dupetor flavicollis flavicollis (Latham).

Ardea flavicollis Latham, Ind. Orn., vol. ii (1790), p. 701—Oude, India.

The Black Bittern must be very generally distributed, I presume as a resident, throughout the western side of the Presidency, as in addition to Jerdon's somewhat vague statement that he had seen it on the Malabar coast in rice fields, there are several records. A specimen from Calicut is in the Hume collection. Mr. Betts informs me that he came upon one in Coorg, almost treading on it as he climbed a log in a stream bed in a dark wooded ravine. William Davison says that he had seen it in the Wynaad and that he had also seen a specimen killed by a native shikari close to Ootacamund.

Fairbank stumbled on a sepcimen below Vilparti in the Palnis in 1867 under much the same circumstances as Betts. There is an Anjango skin in the British Museum and Ferguson considered it not uncommon along the backwaters in Travancore, frequenting the more thickly covered canals.

On the eastern side it is only reported from the neighbourhood of Madras near which place Jerdon saw it. There is a local specimen in the Madras Museum.

Botaurus stellaris (Linnaeus).

Ardea stellaris Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 144—Sweden.

The Bittern is an occasional straggler to the Presidency. There may perhaps be some doubt about Jerdon's statement (*Madras Journ. Lit. Sci.*, No. 29 (1840), p. 198) that he had seen a specimen shot in the Nilgiris in the hot season and it is to be noted that he does not repeat it in the *Birds of India*.

There is, however, no doubt about the specimens recorded by Rhenius (*J.B.N.H.S.*, xvii, 247) near Cuddalore, about 120 miles south of Madras and by Captain C. B. Harrison, I.M.S., from near Madura (*J.B.N.H.S.*, xvii, 1037). Both were obtained about 1907 but exact dates are not given.

Phoenicopterus ruber roseus Pallas.

Phœnicopterus roseus Pallas, Zoogr. Rosso-asiat., vol. ii (1827), p. 207—Mouth of the R. Volga, Caspian Sea, South Russia.[1]

Jerdon tells us that he saw the Flamingo in the greatest abundance at the Chilka Lake where many hundreds were gathered together. It is still said to be found there, though less frequently and in smaller numbers than formerly as the lake is now more accessible to sportsmen than in former days (Stuart Baker, *Game Birds*, i, p. 4). Jerdon also says that the bird is very abundant in the Pulicat Lake near Madras (where Dewar says they are to be found every cold weather, he himself having seen over a thousand there), between Madras and Pondicherry and still further south towards Tuticorin. Throughout this last district W. N. Fleming writing in 1892 (*J.B.N.H.S.*, xii, p. 216) says the Flamingo is fairly common. One large flock, he continues, of quite 300 frequented a shallow piece of water, about three miles from Tuticorin, all the cold weather and remained until the end of April when the water dried up. It was however still in the neighbourhood in July.

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[1] For the use of this name see Grant and Mackworth-Praed, *Bull. B.O.C.*, vol. liv (1933), pp. 16-17.

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Major Phythian Adams (*B. of S. India*, p. 465) says that he met with a flock of many hundreds near Dhanushkodi at the end of March or beginning of April 1922. They were on the lagoon beside the railway line.

There is no reason to believe that the Flamingo breeds in the Presidency and there is no information on record regarding their arrivals or departure beyond a very interesting note by S. C. Law (*J.B.N.H.S.*, xxx, 226). In 1924 Mr. Law was at Vizagapatam and on 19 August he saw about 150 Flamingoes flying past out at sea, about a mile from the coast, at 12-30 midday. They were travelling very low over the sea and flying from due north to south. Next day a similar flock was following the same line at the same time and on 24 August a still larger flock was noted about 3 miles out at sea at 7-30 a.m., also flying south and quite high in the air.

Sarkidiornis melanotos Pennant.

Anser melanotos Pennant, Ind. Zoology (1769), p. 12, pl. xi—Ceylon.

The Nukta or Comb-Duck appears to be rare in the Presidency and there is very little on record about it. Hume says (*S.F.*, x, 417) that he believes it occurs in the Wynaad. Theobald is quoted (apud Hume and Marshall, ii, 91) to the effect that south of Mysore he had only seen it in the Collegal Taluq of Coimbatore and not to the best of his belief further south. He adds that it comes about December and leaves again in February and March but is very rare, only 4 or 5 pairs coming each year. Mr. Hatchell records it from the Sripuram Tank near Podanur (*Birds of S. India*, p. 467).

On the eastern side the only information is furnished by two specimens in the Madras Museum supposed to have been collected at Madras and Chingleput and the fact that Mr. R. F. Stoney kindly informs me that he shot 4 Comb-Duck in the Godavery district in the season of 1928-29.

There are two specimens labelled 'Madras' in the British Museum.

Rhodonessa caryophyllacea (Latham).

Anas caryophyllacea Latham, Index Orn., vol. ii (1790), p. 866—India.

All that is known about the former status of the Pink-headed Duck in the Presidency will be found in *Game Birds*, vol. iii, p. 175. Here Hume says:—It certainly occurs in the Pulicat Lake as I have a specimen shot there [this is presumably the immature specimen marked 'Madras' in the Hume collection], and Jerdon years previously had obtained a specimen in the Madras market caught there, and another from Nellore. Again north of Nellore it appears to occur in suitable situations in Vizagapatam and Ganjam. 'The locality Vizagapatam is expanded in the following footnote from Lt.-Col. W. J. Wilson.—"The Pink-headed Duck used to frequent a piece of water near Condakirla about 27 miles south of Vizagapatam and in all probability is still to be found there, as well as at similar places in the Northern Circars, although I do not now remember having actually seen it except at Condakirla . . . to the best of my recollection the Pink-headed Duck I shot were killed in November and December. I think I saw about 15 or 20 on each occasion of my visit."'

The Pink-headed Duck is now so dwindling in numbers that the chance of its occurring again in the Presidency is of the very slightest.

Nettapus coromandelianus coromandelianus (Gmelin).

Anas coromandeliana Gmelin, Syst. Nat., vol. i, pt. ii (1789), p. 522—Coromandel coast.

The Cotton-Teal seems to be fairly generally distributed in the Presidency but it is not found in large numbers and I find no notes that allow one to arrive at its status accurately. On the western side it is evidently rare. Major Phythian Adams who has shot at Cannanore for the seasons 1925-1926 to 1935-1936 only met with it there on two occasions, viz. 2 birds on 10 December 1930 and a party of 6 on 27 November 1933. Hume says it occurs in the Wynaad (*S. F.*, x, 417). Kinloch recorded (*J.B.N.H.S.*, xxvi, 674) 4 shot in the Nelliampathies. In Travancore Ferguson thought it was a winter visitor and never abundant at any time.

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In the rest of the Presidency I have records from Ganjam, Vizagapatam, Kistna, Madras, Chingleput, Salem, Tanjore, Coimbatore, Madura, Tinnevelly and Tuticorin. These are mostly supplied to me by Mr. R. F. Stoney whose *Game Book* shows a total of 72 Cotton-Teal shot in the years 1903-1931. At Tuticorin Mr. W. N. Fleming (*J.B.N.H.S.*, xii, 216) calls this little duck 'fairly common during the cold weather until the end of April' but more numerous at Tinnevelly.

An albinoid specimen from Madras is described by W. F. Dique (*S.F.*, ix, 508).

Anser indicus (Latham).

Anas indica Latham, Index Orn., vol. ii (1790), p. 839—India.

A winter visitor. In Hume's day the Bar-headed Goose was extremely abundant at the Chilka Lake (*Game Birds*, iii, 82) and according to Annandale (*Records Ind. Mus.*, xxii, 329) it is still found there and remains as late as the beginning of April. Mr. R. F. Rainey informs me that he shot 4 in the Kistna district in the season 1905-1906. Mr. Hatchell records it from near Nellore and Cuddapah, and geese, which are probably of this species, are reported to frequent the sea coast as far south as Pamban Island (*Birds of S. India*, p. 471).

Mr. Albert Theobald (apud *Game Birds*, iii, 82) says 'I have not seen this Goose south of Coimbatore. I have shot them in the Collegal Taluq only; they come at the end of November or early in December and leave about February or March—a few stragglers being found in April in the Agaroram tank about 3 miles from Collegal. They are far from common, only a few, ten to twenty, being found in a flock.'

W. N. Fleming, however, says it is a regular cold weather visitor to Tuticorin (*J.B.N.H.S.*, xii, 216) and he remarks on the considerable but unusual numbers that arrived in the cold weather of 1897-98 and were there from November until the end of February. He saw one flock containing about 50 birds and 5 birds were brought to him in one day by a 'pot hunter'.

Finally it is necessary to recall—but not to attach too much importance to—Jerdon's oft quoted statement that he once saw a pair in August in a small sequestered tank within a few miles of Cape Comorin.

Dendrocygna javanica (Horsfield).

Anas javanica Horsfield, Trans. Linn. Soc., vol. iii, pt. i (May 1821), p. 199—Java.

My information about the Whistling Teal is far from complete and its status is not clear. Large flocks occur on the Chilka Lake but according to Annandale (*Records Ind. Mus.*, xxii, 330) they appear to leave as soon as the rains set in and are not seen between the end of June and November. Mr. Rainey has shot it in the Ganjam and Kistna districts and also down in Madura, and Dewar includes it without comment in his Madras list. In Tuticorin W. N. Fleming (*Journ. B.*, xii, 216) calls it rarer than the Cotton-Teal but apparently pretty plentiful in December, January and February.

On the western side Hume (*S.F.*, x, 417) says he has seen it from the Wynaad. Phythian Adams informs me that he has met it in Cannanore in December. Ferguson says that it is common on all weedy tanks throughout Travancore but perhaps commoner in the north than in the south. On one piece of fresh water near Sastancottah he saw hundreds in April 1902 though there was not a single bird in the same place in December 1903. It is probably to this species which Mr. Sherman refers (apud Hume and Marshall, iii, 119) where he says that it is generally seen in N. Travancore only from October to April but that some must stay and breed as he has seen young in August.

[Dendrocygna fulva (Gmelin).

Anas fulva Gmelin, Syst. Nat., vol. i (1839), p. 530—Nova Hispania.

Jerdon is said to have obtained the Large Whistling Teal occasionally near Nellore but details are lacking and there appears to be no authentic information

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about the occurrence of this species in the Presidency. Annandale does however, record a pair on the Chilka Lake as frequenting Barkuda Island during the rainy season of 1919 (*Records Ind. Mus.*, xxii, 330).]

Casarca ferruginea (Vroeg).

Anas ferruginea Pallas in Vroeg, Cat. d'Ois. Adumb. (1764), p. 5—Tartary.[1]

Sherborn remarks re the type loc. of *ferruginea* as follows:—No locality cited 'Tartarysche Gans. *Anser Tataricus ferrugineus Mas*' in catalogue.

The Ruddy Sheldrake or Brahminy Duck is a winter visitor to the Presidency in small numbers. It is fairly common on the Chilka Lake (Stuart Baker, *Game Birds*, i, 140, Annandale, *Records Ind. Mus.*, xxii, 330) while Mr. R. F. Stoney kindly informs me that in the Kistna district he shot one in the season 1905-1906 and three more in the season 1923-1924.

On the western side Major Phythian Adams informs me that he killed a bird from the only pair he has ever seen at Cannanore on 15 November 1935.

Theobald (apud Hume and Marshall, iii, 123) says that he had shot them in the Salem, Tinnevelly and Coimbatore districts. They come in about November and leave about March. They are not common, seldom more than 3 or 4 in a batch. In 1869 he shot one in the Collegal Taluq as late as June, but this must surely have been a pricked bird.

Anas poecilorhyncha poecilorhyncha Forster.

Anas poecilorhincha Forster, Indische Zoologie (1781), p. 42, pl. xii, fig. 1—Ceylon.

The status of the Spot-bill in the Presidency is not very clear. A few pairs were noted on the Chilka Lake in April and June 1920 by Annandale (*Records Ind. Mus.*, xxii, 330). Mr. R. F. Stoney informs me that he has shot it in the Vizagapatam, Kistna, Kurnool and Tanjore districts, the total for the seasons 1904-1905 to 1930-1931 coming to 25 head. Dewar includes it without comment in his Madras list.

At Tuticorin W. N. Fleming (*J.B.N.H.S.*, xii, 216) says that it occurs in small numbers but apparently arrives after the cold weather as he saw none until March while 2 were brought to him by a shikari on 12 July.

Chaulelasmus streperus (Linnaeus).

Anas strepera Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 125—Sweden.

The Gadwall is a winter visitor in small numbers to the north-east of the Presidency and Mr. R. F. Stoney has kindly sent me details of nine individuals he has shot in the Vizagapatam and Kistna districts in the seasons 1903-1904 to 1930-1931. Dewar includes it in his Madras list without comment but it must be remembered that his list of ducks was made from the specimens in the local Museum and it is not quite certain where all of these came from.

On the western side Hume (*S.F.*, x, 418) was almost sure that it had been reported to him from the Wynaad.

Mareca penelope (Linnaeus).

Anas penelope Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 126—Sweden.

The Wigeon is a winter visitor to the Presidency but it is evidently neither general nor common as Mr. R. F. Stoney in the details of his bags for the seasons 1903-1904 to 1930-1931 can only tell me of two that he has shot, one in Kistna district, season 1923-1924, and the other in Vizagapatam district 1928-1929.

In Tuticorin Fleming considered them fairly common though their stay was short. It will be remembered, however, that this is one of the ducks whose numbers in India vary a great deal from year to year.

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[1] There is no copy of Vroeg Cat. d'Ois. in the British Museum but Sherborn made a facsimile copy some years ago which was published in *Smithsonian Misc. Bull*, 47, pp. 332-347.

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Nettion crecca crecca (Linnaeus).

Anas crecca Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 126—Sweden.

The Common Teal is a winter visitor to the Presidency and it is no doubt common and widely spread though I cannot trace much information about it. On the eastern side Mr. R. F. Stoney informs me that he has shot it in the districts of Ganjam, Kistna, Chingleput, Tanjore and Madura though his *Game Book* only records a total of 27 for the seasons 1903-1904 to 1930-1931. Theobald (apud Hume and Marshall, iii, 207) records Teal at Tinnevelly as being found in great abundance in the large tanks south of Palamcottah and Fleming (*J.B.N.H.S.*, xii, 216) calls them plentiful throughout Tuticorin district.

On the Malabar coast the Teal seems to be virtually unknown but Ferguson says he obtained a single specimen in South Travancore. On the Nilgiris William Davison says that small parties occasionally drop into the lake at Ootacamund but are not permitted to stay there long.

According to Theobald this duck usually arrives in South India at the beginning of the north-east monsoon about November and leaves again in March and April while he shot some in the Tinnevelly district as late as 15 May.

Dique (*S.F.*, ix, 508) remarks that he has heard of an albino Teal, obtained presumably at Madras.

Dafila acuta (Linnaeus).

Anas acuta Linnaeus, Syst. Nat., ed x, vol. i (1758), p. 126—Sweden.

The Pintail is a winter visitor to the Presidency but I have very little information about it. In the seasons 1903-1904 to 1930-1931 covered by his *Game Book* Mr. R. F. Stoney informs me that he has killed a total of 7 birds in the Kistna and Tanjore districts and Dewar includes the species in his Madras list without comment.

At Tuticorin Fleming (*J.B.N.H.S.*, xii, 216) says the Pintail is by far the commonest duck, remaining from November to March in large flocks of 200 to 300 birds.

On the Malabar coast it is rare or wanting, but Hume says it occurs in the Wynaad though reported rare there.

Querquedula querquedula (Linnaeus).

Anas querquedula Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 126—Sweden.

The Garganey is evidently the most numerous species of Duck which is found in the Presidency and the fact that Mr. R. F. Stoney's *Game Book* gives a total of 144 shot in the seasons 1903-1904 to 1929-1930 furnishes an idea of its numbers compared with other species. It occurs apparently on every suitable piece of water from the Chilka Lake to Cape Comorin but its principal headquarters in the winter seem to be the backwaters of Travancore where very large flocks are to be found.

Theobald (apud Hume and Marshall, ii, p. 216) says that the Garganey arrives in Southern India (i.e. south of Mysore) about the early part of December and leaves by March or April, a few stragglers remaining till May or June and this agrees roughly with what Fleming says at Tuticorin (*J.B.N.H.S.*, xii, 216). Major Phythian Adams however says (*Birds of S. India*, p. 479) that he has found a party at Cannanore as early as 24 September 1927.

Spatula clypeata (Linnaeus).

Anas clypeata Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 124—South Sweden.

The Shoveller is not a very common winter visitor to the Presidency. Mr. Stoney's *Game Book* for the seasons 1903-1904 to 1930-1931 shows a total of 13 birds shot in the Ganjam and Kistna districts and specimens in the Madras Museum are said to have been procured at Madras and Chingleput.

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On the western side Hume says (*S.F.*, x, 417) that he has received a specimen from the Wynaad.

Netta rufina (Pallas).

Anas rufina Pallas, Reise Russ. Reichs., vol. ii (1773), p. 715—Caspian Sea.

Mr. Stoney informs me that he killed 12 Red-crested Pochards in the Vizagapatam district in the season of 1928-1929. There are two specimens in the Madras Museum labelled Madras and Arkonam but I can find no other record for the Presidency.

Nyroca ferina ferina (Linnaeus).

Anas ferina Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 126—Sweden.

The Pochard is a scarce winter visitor to the Presidency. Mr. Stoney informs me that he shot two in the Vizagapatam district in the season 1928-1929 and one was killed at Bellary on 6 December by Colonel McMaster (Hume and Marshall, iii, 247).

[Nyroca rufa rufa (Linnaeus).

Anas rufa Linnaeus, Fauna Suec. ed. ii (1761), p. 47—Sweden.

There is no definite record of the White-eyed Pochard in the Presidency beyond Hume's general statement (*Game Birds*, iii, 263) that it occurs in the Northern Circars and that he has no record from south of Madras.]

[Nyroca marila (Linnaeus).

Ans marila Linnaeus, Faunna Suecica, ed. ii (1761), p. 39—Lapland.

I find difficulty in accepting the correctness of Colonel McMaster's idea that 'one year, in January, he saw several birds of this species, on marshes and salt lakes between Chicacole and Berhampore in the Northern Circars (say 19° N. Lat.)' (Hume and Marshall, iii, 271).]

Nyroca fuligula fuligula (Linnaeus).

Anas fuligula Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 128—Sweden.

Theobald (Hume and Marshall, iii, 278) says that he met this duck in the northern part of Coimbatore. Otherwise the only information that I have of it in the Presidency is furnished by the 11 birds in Mr. R. F. Stoney's records, shot in the seasons from 1903-1904 to 1930-1931 in the Vizagapatam, Godavery, Kistna, Chingleput and Chittoor districts. Hume says, that it has been shot near Bellary.

Podiceps ruficollis capensis Salvadori.

Podiceps capensis Salvadori, Ann. Mus. Civ. Gen. (2), vol. i (1884), p. 262—Shoa, East Africa.

William Davison tells us that he had found the Little Grebe in several places in the Wynaad and that it is a permanent resident on the lake at Ootacamund where it breeds in large numbers in May and early June (*N. & E.*, iii, 404)—Cardew adds early August. As Jerdon points out this lake is artificial in origin and migrating birds must travel at a considerable height to have found and colonised it. Fairbank says that it is also resident on the lake at Kodaikanal in the Palnis, where Terry later found it. In Travancore it is also resident, according to Ferguson, and breeds in August.

On the eastern side the only information that I can find about it, beyond Davison's inclusion of the bird in his Madras list is the fact that A. G. R. Theobald found a nest on 19 August on a lake near Ahtoor in the Shevaroys (*N. & E.*, iii, 404).

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(*THE END*).

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THE SNAKES OF DEOLALI.

With Notes on their comparative Osteology and peculiarities of Dentition.

BY

A. G. L. Fraser, I.M.D.

Part III.

(*With 4 plates*).

(*Continued from page 290 of this volume*).

SUB-ORDER: OPHIDIA

Family: Typhlopidae

Species: **Typhlops braminus** (Daud.). The Worm Snake. There appears to be no local name for it.

Exoskeleton.—The body is uniformly rounded throughout, without showing any distinction between the head, body and tail. There is a covering of cycloid scales, which give it the semblance of a worm. The distinction of the ventral shields is purely arbitrary, as they are not enlarged. The anal shield is not differentiated. The costal scales average 20 in the count. The snout is rounded. The tail is abbreviated and terminally spined.

Colour.—This snake dorsally shows varying shades of brown. The brown colour tone is lighter anteriorly and ventrally; in the anal region the colour is white.

Length.—The smallest measured 3 in. and the largest 7 in.

Eye.—This is comparatively distinct and the pupil is spherical.

Endoskeleton.—Skull. There is a heavy bone formation anteriorly. There are no squamosals and no ectopterygoid bones. The pterygoid is cartilaginous and does not touch the mandible. The maxilla is transversely placed and equipped with one tooth. The praefrontal shows a suture with the nasals. The mandible is toothless and the coronoid bone is present. The vomer and turbinals are heavily formed and convexed on the ventral aspect. Immediately behind the eye is a depression or sulcus for the reception of the poison gland.

Vertebrae.—There are no neural spines and the hypapophysis is absent throughout the vertebral column. The caudal section is very short and terminates abruptly. The cloacal vertebrae show a rudimentary pelvis.

Glandular structures.—In the sulcus immediately behind the eye and above the temporalis anterior muscle is a small gland.

Locomotion.—The zigzag spiral motion is not exaggerated and is the same as the movement noted for *Lycodon aulicus*.

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Habitat.—Peninsular India, Burma, Ceylon, Mexico, South of the equator in Africa, Arabia to S. China and coastal islands (Wall).[1]

Note:—Appears chiefly during the rains in Deolali. A young specimen 3 in. long was secured in a garden during October. An adult was found swimming in a receptacle of water. Another was retrieved from the mouth of a dog. In this case the snake's back was found broken.

This is a typically burrowing snake.

FAMILY: BOIDÆ.

SUB-FAMILY: PYTHONINAE

Species: **Python molurus** (Linn.). The Python or Rock Snake.

Local name.—*'Azgar'.*

Exoskeleton.—This snake presents a massive formation. The snout is long. The head is flattened dorso-ventrally and is posteriorly broad. The jaws are heavy and the musculature well developed. The neck is distinct. Anteriorly the body is comparatively slender; the rest of the body is massively built and heavy. The tail is short, thick, strongly formed, and terminates abruptly.

The scales are smooth, juxtaposed and as broad as long. In the two specimens secured the costal scales numbered 63 and 72 respectively. The ventrals numbered 244 and 250 and stretched across the belly. The anal shield was entire. Near to the cloacal aperture, one on either side were excrescences of a horny nature resembling claws. These are said to be vestigial hind limbs.

Colour.—The head showed black markings. A linear brown streak crossed the eye and another ran below it. Dorsally there were reddish brown spots edged with black. A smaller series of similar spots ran laterally on either side laid on a background of yellowish brown. The belly was white.

Eye.—Small. The pupils vertical.

Endoskeleton.—The osteology and dentition of this species was not studied. As regards the dentition, the only peculiar feature obtaining with the python is that the praemaxilla is dentigerous.

The gland structures were not investigated.

Locomotion.—This is by movement in the straight axis of the body.

Habitat.—Ceylon; Peninsular India, to the extreme limit of Sind; Himalayas—Dehra Dun to Sikkim; Assam, Burma, Siam, S. China and the coastal islands, Malay Peninsula and Archipelago, Java (Wall).

Note:—Secured during daylight in outlying quarries beyond the rifle range in the cold weather months.

Length.—5 ft. 6 in. and 6 ft. 2 in. Sex not ascertained.

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[1] The distribution shown is that quoted in the paper 'The Snakes of Bombay Island and Salsette' by S. H. Prater, C.M.Z.S. (April 1926): taken from Col. Wall's 'Hand list of Snakes'. This information will be repeated for all the species.

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SUB-FAMILY : BOINAE.

Species: **Eryx conicus** (Schn.). The Earth Boa (red).

Local name.—The local inhabitants regard this snake as the young of the Python and because of the colour resemblance call it 'Azgar'.

Exoskeleton.—The snout is pointed. The head is anteriorly narrow and posteriorly broad. It is comparatively small for the size of the body. The neck division is distinct. The anterior third of the body is narrower than the middle and posterior third, which is stoutly and broadly built. The tail is thick, short and blunted. It is roughly 1/10th of the body length.

The epidermis consists of juxtaposed nodular scales, which are as broad as long and dorsally keeled. The keeling is more marked over the caudal area. On the head the rostral and internasal shields are well defined. The supralabials number 13. The costal scales number 37 to 42 in the anterior third, 45 to 49 in the middle third and 29 to 35 in the posterior third of the body. The ventral plates number from 174 to 180. These are slightly enlarged and do not extend across the belly, being actually half the width. The anal shield is divided into three sections. The subcaudals are entire throughout and number from 18 to 21.

Length.—The smallest in the series measured 9 in. and the largest 2 ft. 3 in.

Colour.—A series of irregular dark brown or reddish brown patches edged with black, placed on a background of buff or wheat. The belly in the adult is white. In the young the colour tones are lighter and the belly is pink.

Eye.—This is small and the pupil is vertical.

Endoskeleton.—Skull. In the young the anterior part of the skull for two-thirds of its length is slightly oval. In the adult it presents a triangular shape. The posterior half is constricted in the mastoid region. The intermaxillary is well defined and overlaps the maxillary bone. The maxillaries are broad and long. A suture divides the frontals and nasals. The praefrontals are small. The parietals are ridged centrally in the long axis. Behind the postfrontal zygoma is a depression for the lodgement of the poison gland. The quadrate is a rod-like bone. The pterygoid is posteriorly broad, ventrally grooved and touches the mandible. The ectopterygoid is small. The articular end of the mandible is broadly formed. The palatine bones are small.

Dentition.—There are no grooved fangs. All the teeth are solid and recurved. The maxillary teeth number in the young 12, and in the adult 16; the anterior are the largest and the posterior diminish in size. The palatine teeth number 5 on either side; the anterior ones are large. The pterygoid teeth number in the young 7, and in the adult 12; they are all small and of equal size. The dentary part of the mandible is provided with 16 teeth; the anterior are very large.

Vertebrae.—The neural spines are rudimentary and show tubercles on the posterior neural arches. In the caudal vertebrae the neural spines present the normal squared plate-like extensions seen

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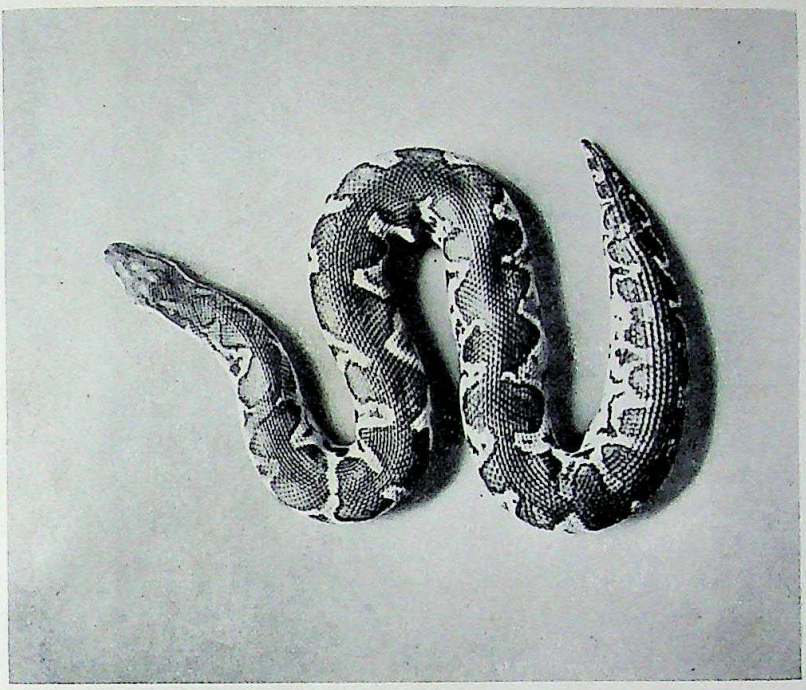

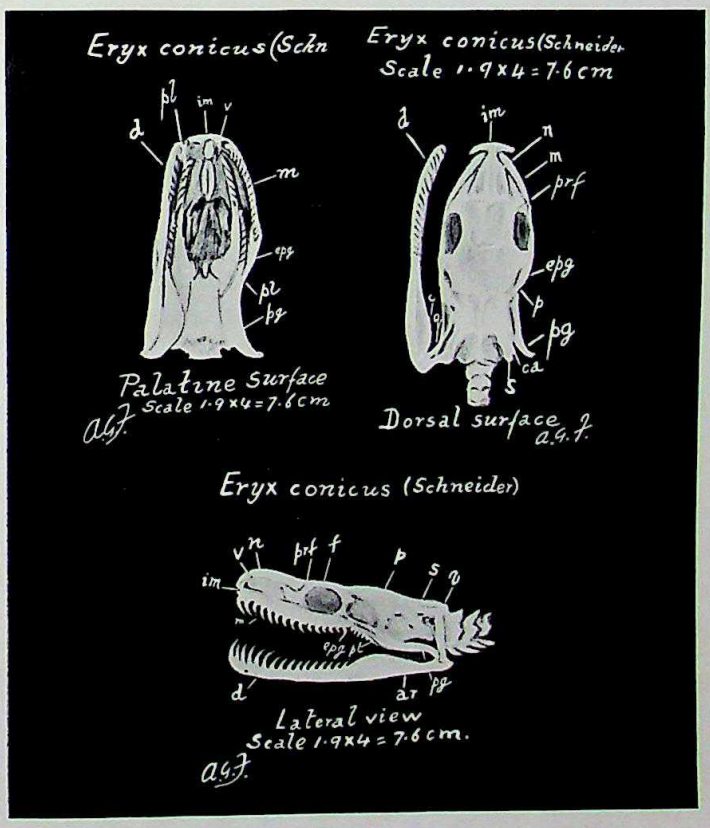

The Red Earth Boa (*Eryx conicus*).

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(For explanation of lettering on plates, see end of article.)

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in the species in which the spines are small. The hypapophysis is well developed in the cervical vertebrae and in the thoracic series gradually diminishes in size. It is absent in the dorsal vertebrae.

Ribs.—The ends are bulbous. They are small in length in the cervical and part of the thoracic sections and increase in length from thence until the maximum size is attained about the middle third of the body. There is a corresponding decrease up to the cloacal vertebrae, where are featured two rib processes fused with the vertebrae. In the caudal vertebrae there is a single rib process similarly ankylosed to the body of the vertebra.

Locomotion.—A slow-moving snake—the spirals in the zigzag motion are much exaggerated, even more so than in the Russell's Viper.

Glandular structures.—In the depression behind the post-frontal zygoma and above the temporal muscle, immediately behind the eye is a small gland. The closely related *Eryx jaculus* (Linn.), has a similar gland. Col. Gharpurey[1] (Nov. 1932), Case 7, reported the case of a woman, who was bitten by an *Eryx conicus* without ill effects.

Habitat.—Peninsular India: South of the Himalayas, Ceylon.

Note:—This snake is aggressive. It will snap with a startling suddenness on the least provocation. If touched it displays resentment by leaping in the air about half an inch off the ground with the body in a rigid contracted state. It then slithers along the ground in a series of short, sharp, jerky side to side leaps, maintaining the rigidity in its body. If left alone it will move normally. It is burrowing in its habits. The tail is prehensile and functions as a constricting finger securing a firm hold on any object, be it a stone or stick. Our specimens were encountered during daylight in the mornings.

Family: Colubridæ.

Sub-Family: Colubrinae (*Aglypha*)

Species: **Nerodia piscator** (Schn.). The Checquered Water Snake.

Local name.—Pani-ki-samp.

Exoskeleton.—The snout is pointed. The head is oblong and narrow. The neck is slightly demarcated. The anterior or cervical portion of the body is thinner. The body is dorsally ridged and laterally compressed and the maximum thickness is attained in the middle third. The tail is round and tapering. The scale formation shows head shields and large imbricated scales on the body. The costal scales are dorsally distinctly keeled, especially in the middle third. Laterally the keeling is less marked. The supralabials are 9 in number—the first and second touch the nasal shield, the fourth and fifth touch the eye, the seventh and eighth touch the temporal shields. There is only one loreal. The praeoculars number 2 and

[1] 'Snakes in Ahmednagar' by Lt.-Col. K. G. Gharpurey, I.M.S., *Journ. Bom. Nat. Hist. Soc.*, vol. xxxvi, No. 1, p. 272, 15-11-1932.

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the postoculars 3. The costal scales average 19, 17 or 19, 17, in the anterior, middle and posterior third of the body, respectively. The ventrals number from 141 to 148. The anal shield is divided into two sections. The subcaudals are divided throughout and number from 77 to 89.

The naris is placed superiorly.

Length.—The smallest measured 8 in. and the largest 3 ft. 8 in.

Colour.—Sepia tones on the head. The costal margin is yellowish green. Dorsally there are irregular black and orange mottlings on a background of dark green. Each scale in fact is edged with black or orange. The belly is pale yellow anteriorly, buff coloured in the middle third and faintly pink under the tail. The iris is yellow and the pupil is spherical.

Endoskeleton.—Skull. The anterior part of the skull is broader than the posterior half. The intermaxillary overrides the maxilla. The nasal is specifically small and the division between it and the maxilla and praefrontal is bridged over by cartilaginous strips. The maxillary bones are thin and long. The praefrontals are suturally united with the frontals but do not touch the nasals. The ectopterygoid is thin and medium-sized; its maxillary articular end is a squared plate with the inner anterior angle projected forward in the shape of a finger extension. The squamosals are broad, flat and long. The quadrate is superiorly broadly spatulate and grooved. The articular end of the mandible is broadly formed. The pterygoid is posteriorly broad and ventrally grooved and touches the mandible.

Dentition.—The maxillary teeth number 17; the posterior ones are the larger. The palatine teeth number 8; the anterior are larger. The pterygoid teeth number 22; they are all small and of equal size. The dentary is provided with 24 teeth; the anterior and middle series are the largest. On the outer or maxillary side of the palatine and pterygoid bones, below the operative teeth in use, is a double row of reserve teeth imbedded in the wall of the bones. Similarly the maxillary bones on their inner aspect are provided with a double row of reserve teeth.

Vertebrae.—The neural spines are well developed in the form of squared plate-like extensions. The hypapophysis is present in a uniform and pronounced character throughout the cervical, thoracic and dorsal vertebrae.

Ribs.—The free ends are blunted and slightly bulbous. They are longest in the middle third of the body, and the anterior and posterior third parts of the body show the ribs gradually diminishing in length. The cloacal and caudal vertebrae show the double and single processes fused with the body of the vertebra. This is a feature with all snakes and need not be repeated in the descriptions of the other species to follow.

Locomotion.—The movement, both in the act of swimming in water and the motion on land, in as far as the spiral action is involved, appears identical. It is the same as that seen in *Lycodon aulicus*.

Gland structure.—This snake is provided with a large parotid gland. The toxicity of its secretion was observed by Alcock and

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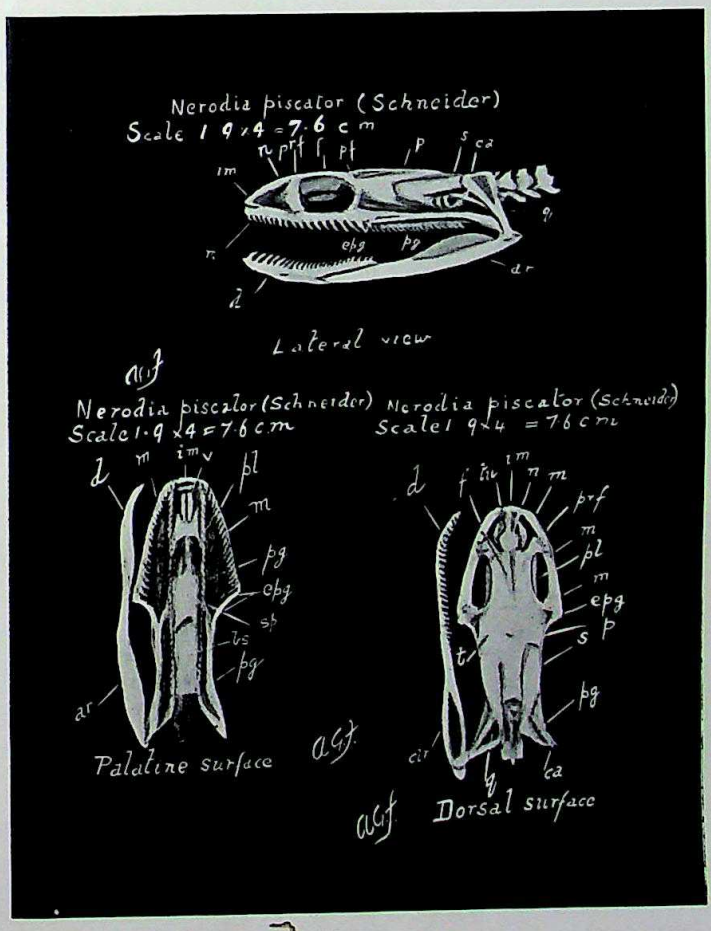

The Checquered Water Snake (*Natrix piscator*)

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Rogers in 1901. Mme Phisalix and Caius (1916) have confirmed this. Its venom kills birds, lizards, frogs and small mammals. Its bite would not seriously harm man or the larger animals.

Habitat.—Peninsular India, Ceylon, Burma, Andamans, Malay Peninsula and Archipelago, Siam, Indo-China, China, Formosa (Wall).

Note:—The majority were secured by day on the banks of the river 'Darna' and in its tributary streams. There were two gravid females in which eggs were found—in one 26 and in the other 16 in a state of early development.

Species: **Rhabdophis stolatus** *Tropidonotus stolatus* (Linn.). The Buff-striped Keel-back. There appears to be no local name for this snake.

Exoskeleton.—The form is proportionately slender. The snout is obtusely rounded. The head is ovate and dorsally convexed. The body for two-thirds of its length is of a uniform thickness. The neck is well defined and the tail is long and tapering. The naris is laterally placed.

Scale formation.—There are large head shields present. The costal scales are longer than broad, imbricated and heavily keeled throughout. The supralabials number 8; the first of these touches the nasals; the third, fourth and fifth touch the eye, and the sixth and seventh the temporals. As in the case of all Colubridae the sublinguals are in two pairs. There are 1 praeocular and 3 postoculars. There is one loreal. The ventrals number from 150 to 153 and stretch completely across the belly. The anal shield is divided into two sections. The subcaudals number from 75 to 87 and are divided throughout. The costal scales number 19, 19, 19-17, in the anterior, middle and posterior third of the body respectively.

Colour.—The head is a very dark brown and the parietal shields are stippled with yellow. The supralabials are orange tinted. The infralabials and the under surface of the neck are tinged yellow. On either side from the neck backwards in the long axis are two buff-coloured stripes laid on a background of sepia. There are black striations stippled with creamy yellow spots transversely placed at intervals. These striations do not involve the buff stripes flanking the body and they are more conspicuous anteriorly and fade towards the tail. Dorsally over the tail the colour is brownish yellow. The ventrals in the anterior half are spotted black. The belly is pale yellow. The young specimens show fresher colour tones. Spirit specimens kept for long periods change to a slate colour.

The length was:—The largest 21½ in. and the smallest 11 in.

Eye.—This is large. The iris is golden and the pupil spherical. The nares are laterally placed.

Endoskeleton.—Skull. This is ovate in formation. The inter-maxillary is wedged in between the maxillary bones. The nasal bones are small. The praefrontals are suturally united with the frontals and the division between them and the nasals is covered over with a cartilaginous septum. The temporal bones laterally

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bulge. The parietals posteriorly terminate in three bony spicules placed over the supraoccipital. The squamosals are flat, narrow and of medium length. The quadrate is superiorly spatulate and short. The articular end of the mandible is broadly formed but the dentary portion is slender and long. The maxillary bones are long and thin. The pterygoids are narrow and are not ventrally grooved. They touch the mandibles. The ectopterygoid is thin and small. The palatines are of medium size.

Dentition.—All the teeth are solid, recurved, and comparatively small. None are grooved or perforated. The maxillary teeth number 19; the posterior two are large and set apart. The palatine teeth number 9 and are of uniform size. The pterygoids are set with 12 teeth of small size and of equal length. The dentary is provided with 22 teeth, of which the anterior ones are the larger. Only the maxillary bones appear to be provided with a row of reserve teeth.

Vertebrae.—The neural spines are small and plate-like squares. The hypapophysis is of nearly uniform size throughout the cervical, thoracic, and dorsal vertebrae.

Ribs.—The free ends are pointed. They are short in the cervical section and of uniform length for the greater portion of the body, diminishing in size towards the cloacal region.

Gland structure.—This snake is provided with a parotid gland. The experiments of Mme Phisalix and Caius have established the toxic character of the secretion to small animals, birds, rodents, lizards (1917).

Locomotion.—This has not been personally observed.

Habitat.—Peninsular India including the Himalayas up to 5,000 ft., Burma, Ceylon, Andamans and Nicobars, Malay Peninsula, Siam, China, Formosa, Philippines (Wall).

Note:—Appears during the rains. It is an uncommon species in Deolali. It æstivates during the hot weather.

Species: **Polyodontophis subpunctatus** (Dum. and Bibr.) Jerdon's Polyodont.

Local name.—None.

It is a rare snake in Deolali. Only one specimen was secured.

Exoskeleton.—Shows a slender formation throughout and a uniform roundness. The head is small and there is no distinction between it and the neck. The tail is round and of medium tapering length.

Scale formation.—There are head shields present. The body scales are imbricated and as long as broad. There is no keeling in evidence. The supralabials number 9, of which the first and second touch the nasals; the fourth, fifth and sixth touch the eye and the seventh and eighth the temporal shields. The costal scales number 17, 17, 17, in the anterior, middle and posterior third of the body respectively. The ventral shields number 198 and stretch completely across the belly. The anal shield is divided into 2 sections. The subcaudals number 68 and are divided throughout.

Length.—16 in,

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Eye.—Small and the pupil spherical.

Colour.—The head was black anteriorly. The praefrontal shield and the supralabials were edged with pale yellow. A yellow streak carried backwards from behind the eye ended below the parietal shields in a broad yellow band. The nape of the neck was black with posteriorly a yellow frill. The anterior half of the body showed up a pinkish brown, while the posterior was a light brown. Every alternate scale and sometimes a third one dorsally in the middle line was spotted black. There were two parallel series of black spots on each scale laterally and also on the ventral margin.

The endoskeleton of this specimen was not studied as the skull and vertebral column were badly damaged.

Gland structure.—This snake has a very small parotid gland. The researches of Mme Phisalix and Caius have shown that the secretion from it proved mildly toxic for small vertebrates.

Locomotion.—This was not observed.

Habitat.—Peninsular India (South of Rajputana and the Ganges basin), Ceylon (Wall).

Note:—It was found on the verandah of a bungalow on the 20th February 1934.

Species: **Macropisthodon plumbicolor** (Cantor.). The green Keel-back.

Local name.—*'Hara Samp'* because of its green colour, any green snake would be so called.

Exoskeleton.—This snake is massively formed for its comparatively small length. The head is large and triangular in shape. The jaws are muscularly prominent. The neck is distinct. The anterior cervical portion is thinner than the rest of the body, which is stoutly built especially about the middle third. The tail is of average tapering length.

Scale formation.—There are large head shields present. The supralabials number 7; the first and second touch the nasals; the third and fourth touch the eye; and the fifth and sixth touch the temporal shields. There is one loreal. The praeoculars number 2 and the postoculars 3. The sublingual shields are in two pairs. The costal scales are retiform, imbricated, and show marked keeling. The last costal rows touching the ventrals are large. There is much variability in the count of the costal scales and this is therefore of little practical value for purposes of identification. On an average they number 23, 25, 19, in the anterior, middle and posterior third of the body. The ventral plates number from 140 to 162, and stretch completely across the belly. The anal shield is divided into 2 sections. The subcaudals are divided throughout and number from 37 to 47.

Colour.—In the adult the colour is a uniform dull green; in the sub-adults there are faint black striations in some; and in older specimens white striations transversely placed at one inch intervals along the back. The very young and older immature specimens show a broad black chevron on the head. Posterior to this is a chrome yellow chevron. Along the back at regular

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intervals sharp transverse black markings which are continued over the tail. The belly in the adult is white; in the sub-adult slaty, and in the young a bluey black. In the latter along the costal margin there are black markings resembling the capital letter 'I'. Specimens stored in spirit over long periods change to a leaden hue. It is probably because of this that the museum type specimen originally examined led to it being designated *plumbicolor*.

Eye.—This is large. The iris is greenish black and the pupil is spherical.

Length.—The smallest in the series measured 6 in. and the largest 2 ft. 9 in. The naris is laterally placed.

Endoskeleton.—Skull. Dorsally viewed it is broad at the orbits and rectangular in shape. The anterior part is shorter and broader than the posterior. The bones are stout and strong and give to it a heavy appearance. The nasals are medium-sized and are laterally broadly winged. The intermaxillary overrides the maxillary bones. The frontals are broad and suturally united with the praefrontals, which are narrow; both are widely separated from the nasals, and linked with cartilaginous strips. The orbital apertures are large. The squamosals are long, flat and thick. The quadrate is superiorly spatulate, broadly triangular and laterally notched; the inferior articular end is long and terminates in a rounded head. The ectopterygoid is long and thick. The maxillary bones are short, anteriorly slightly thick and articulate with the ectopterygoids at almost a right angle. The maxillaries are peculiarly formed, in that there is a fold in the bone length forming a double convexity on its outer border. Superiorly a process of bone articulates with the inferior border of the praefrontal. The pterygoid is thick, posteriorly broad, ventrally grooved and touches the mandibles. The mandibles are posteriorly broadly built and along with the dentary show a marked convexity on the inferior or ventral surface. The palatines are short.

Dentition.—There are no grooved or perforated fangs—all the teeth are solid. The maxillary teeth number 13. The anterior ones are small and of uniform size. The posterior two are very large and recurved and present the formidable appearance seen in the fangs of the proteroglypha. They are posteriorly ridged and anteriorly rounded and convexed. The palatines have 4—sometimes 5—teeth of one size. The pterygoids are set with 12 teeth of small and uniform size like that of the palatines. The dentary is provided with 18 teeth, those in the middle are slightly larger.

Vertebrae.—The neural spines are large, squared, plate-like extensions. The hypapophysis is well developed and of nearly uniform size throughout the cervical, thoracic and dorsal vertebrae.

Ribs.—Comparatively thicker and longer than in other members of the same family. The free ends are bulbous. The ribs in the anterior third are shorter and longest in the middle third decreasing gradually in the posterior dorsal vertebrae.

Locomotion.—Slow-moving; the spirals are like those seen in *Lycodon aulicus*.

Gland structure.—A large parotid gland. The secretion is toxic for frogs upon which the snake solely feeds.

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Habitat.—Peninsular India—except the Ganges valley up to an elevation of 7,000 ft., Ceylon (Wall).

Note:—Appears in large numbers during the rains and is met with in grass lands. It is meek in character and does not bite even when extremely provoked. The neck is partially dilatable. A marked feature is the power of flattening the body and this is more emphasised when the body is touched. The body is splayed out by muscular action, which extends the ribs laterally to such an extent that the dorso-ventral diameter is markedly reduced. The body then appears flush with the ground and the costal scales become isolated islands on the underlying epidermis. This capacity for spreading out the body aided by the green colour makes for excellent concealment in grass lands.

In two gravid females 11 and 19 eggs were found. There were differences in the size of the eggs, some being longer than others. The eggs were in an early state of development and contained only a creamy fluid.

Species: **Lycodon aulicus** (Linn.). The Wolf Snake.

Local name.—None.

Exoskeleton.—The head is flat, large and elongated. The snout is squared. The neck is distinct. The body is uniformly rounded and of proportionate thickness throughout. The tail is of average tapering length.

Scale formation.—There are head shields present. The supralabials number 9; the first and second of these touch the nasals; the third, fourth and fifth touch the eye; and the sixth and seventh the temporal shields. The praeoculars number 2 and the postoculars 3. There is one loreal. The costal scales are retiform, longer than broad, and show apical pits. They number 17, 17, 15, in the anterior, middle and posterior third of the body respectively. The ventral plates number from 200 to 225 and they stretch completely across the belly. The anal shield is divided into 2 sections. The subcaudals number from 40 to 76, and are divided throughout.

Length.—The smallest measured 6 in. and the longest 28½ in.

Colour.—The head is brown. The supralabials are a creamy yellow carried backwards laterally on the nape. The body is pinkish brown and at alternate intervals there are yellowish white bands edged and spotted with black. The scales on the costal margin are marked in the form of the letters K and H in yellow edged with black. These markings both on the back and sides of the body disappear near the tail. The belly is white. The naris is placed laterally in a somewhat forward position on the snout.

Endoskeleton.—Skull. The formation is rectangular in its length, the greatest width being about the orbits. The nasals are long and large. The intermaxillary lies between the maxillary bones and conjointly with them broadens the muzzle. The praefrontals are rectangular in shape, and suturally united with the frontals, the division between the praefrontals and the nasals is occupied by cartilaginous connections. The frontals are small. The parietals are long and centrally ridged in the long axis. The

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supraoccipital is ridged. The squamosals are thin, small plates of bone. The quadrate is superiorly thinly spatulate and of average length. The ectopterygoid is thin and small. The pterygoid is of average width, ventrally grooved, and touches the mandible. The mandible is posteriorly broadly formed and notched. The dentary portion is thinly formed and long. The maxillary bone, dorsally viewed, shows on the external border a concavity anteriorly and a convexity posteriorly; laterally viewed it is anteriorly broad, with a concavity ventrally and a convexity dorsally, it sweeps downwards, posteriorly thinning out at the articular end in relation with the ectopterygoid. The orbital apertures are large. The palatines are long.

Dentition.—All the teeth are solid and recurved. There are no grooved or perforated fangs. The maxillary bones are set with 15 teeth; their arrangement is peculiar in that the teeth are divided into two series which are separated by an intervening gap devoid of teeth; the anterior set consists of 4 teeth, fixed in a line with the intermaxillary, the two nearest smaller, the outer two large and fang-like; the second series begins at a point just below the praefrontal and the number is 11; the anterior teeth of this series are small, the posterior ones large. The palatines are set with 12 teeth of small and uniform size. The pterygoids are also provided with small uniform-sized teeth numbering 24. The dentary like the maxillary shows the teeth in two series separated by a gap. The first lot consists of 4 teeth of which the first two are smaller than the succeeding two, which are large and fang-like, the second lot number 18, all of them of nearly uniform size. There are some reserve teeth imbedded in the bones on the outer and maxillary border of the palatines and pterygoids, also on the inner aspect of the maxillaries.

Vertebrae.—The neural spines are small squared plate-like extensions. The hypapophysis is large in the cervical vertebrae and gradually diminishes in size up to the end of the last vertebra in the thoracic series. In the dorsal vertebrae the hypapophyses are absent.

Gland structures.—This species has a parotid gland. In addition there is another small pyriform gland situated immediately behind the postfrontal zygoma in the temporal region and communicating with the maxillary teeth by a duct passing under the eye. The secretion from the parotid has been verified by Mme Phisalix and Caius (1917) as producing a toxic condition in small animals. Col. Gharpurey (1932)[1] reported a case No. 4 of a man who was bitten on the face by a young specimen of this species. Except for some local redness and swelling the man suffered no ill-effects.

Ribs.—The free ends are pointed. Those in the cervical region are slightly smaller than the ribs in the rest of the body. They are of uniform size and comparatively shorter than in other species of the same length.

[1] 'Cases of Snake Bite' by Lt.-Col. G. G. Gharpurey, I.M.S., *Journ. Bom. Nat. Hist. Soc.*, vol. xxxvi, No. 1, p. 274.

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Habitat.—Peninsular India, Andamans, Nicobars, Malay Peninsula, Indo-China, China, Malay Archipelago, Philippines (Wall).

Note:—A fairly common snake in Deolali and met with all the year round. More prevalent during the monsoon. It is easily provoked and bites on the least provocation.

Species: **Ptyas mucosus** (Linn.). The Rat Snake.

Local name.—'*Dhaman*'.

Exoskeleton.—The formation in this species is featured by great length, proportionate thickness and a well developed musculature, which suggests a specialisation intended for speed. The head is elongated and the size is in consonance with the body length. The neck is well defined. The body is uniformly rounded and the largest dimension attained is about the middle third. The tail is long and tapering.

Scale formation.—The snout is slightly pointed. There are large head shields present. The supralabials number 8; the first and second touch the nasals, the fourth and fifth touch the eye, and the sixth and seventh touch the temporal shields. There are 1 praeocular, 2 postoculars and 3 to 4 loreals. The costal scales are retiform, imbricated, and longer than broad. On the dorsal aspect the scales for about three rows are slightly keeled and show apical facets. These facets are not seen in freshly killed specimens and appear to be post mortem effects produced by drying. These scales number 17 in the anterior third of the body, 17 in the middle third, and 12 to 15 in the posterior third. The ventral plates number from 196 to 207 and stretch completely across the belly. The anal shield is divided into two sections. The subcaudals are divided throughout and number from 113 to 138.

Colour.—This is variable. The average colour presentation would be that found in specimens 5 feet in length, in which the head shows the appearance of burnt sienna. The supralabials are a creamy yellow and edged with black. The anterior third of the body is uniformly the colour of the head. The middle third is lighter in tone and shows faint creamy yellow striations at intervals edged with black. The posterior third has the striations in black chevron forms. The belly is a creamy yellow and each ventral plate is edged in black. The older specimens exhibit darker colour tones in which the black striations are more subdued and less noticeable.

Length.—The longest specimen secured measured 8 ft. 1 in. and the smallest 3 ft. 4 in.

Eye.—This is large. The iris is yellow and the pupil spherical.

Endoskeleton.—Skull. The bone formation is heavy and a dorsal view shows it to be rectangular. The intermaxillary is large and lies between the maxillary bones. The nasal bone is large and the division between it and the praefrontals is not pronounced. The praefrontals are large and rectangular and from the inferior border anteriorly projected is a process of bone. The frontals are comparatively small for the size and length of this snake. The parietals are large plates which terminate posteriorly in a point. The squamosals are short, flat and thick. The supraoccipital is

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in the form of a bony crest. The quadrate is long, superiorly broad in the form of a triangle and laterally notched. The ectopterygoid is thin, broad and long and articulates with the maxillary bones at a right angle. The pterygoids are comparatively short, particularly broad in the posterior section, ventrally grooved, and they touch the mandibles. The maxillary bones are proportionately thin, long, and inclined downwards towards the ectopterygoids. The palatines are longer than usual. The mandibles are broadly formed posteriorly and notched. The dentary portion is unusually short, being one-third the length of the mandible.

Dentition.—All the teeth are solid and there are no grooved or perforated fangs in evidence. The maxillary bones are set with 16 solid teeth; the anterior are slightly shorter than the posterior ones. The palatines have 12 teeth and the pterygoids 20; all of these are nearly equal in length to those of the maxillary series. The dentary has in the older snakes, six feet and over in length, 12 and in the younger specimens up to 18 solid teeth. The palatines in the younger snakes have 14 teeth and the pterygoids 22 to 24. There are two rows of reserve teeth on the inner aspect of the maxillary bone imbedded in it above the operative set. On the outer and maxillary side of the palatines and pterygoids above the operative teeth are two rows of reserve teeth.

Vertebrae.—Owing to the length and size of this species the vertebrae are proportionately large. The neural spines are also large and in the form of squared plate-like extensions, except in the cervical series where they are finger-shaped. The hypapophyses are particularly large in the cervical vertebrae and they gradually diminish in size up to the last thoracic vertebrae in which they are rudimentary. The dorsal vertebrae show no evidence of a hypapophysis.

Ribs.—The free ends are pointed. They are long and thick—the greatest length being attained in the middle third of the column.

Locomotion.—This has been shown to be an almost straight course with a slight wavy side to side swing. It is the swiftest moving snake of all the species in Deolali.

Gland structures.—It is equipped with a large parotid gland. The venomous nature of the secretion was demonstrated by Alcock and Rogers (1902)[1] who found it produced convulsions in small animals. Mme Phisalix[2] and Caius (1916) have confirmed this.

Note:—Appears in Deolali at all times of the year but in the greatest numbers during the rains. A half-grown specimen was found on the sloping branch of a monkey fig tree. A gravid female was found to contain a string of 12 eggs. It is notable that not a single very young specimen was encountered during the whole period of the survey.

Species: **Zamenis fasciolatus** (Shaw.). The Fasciolated Rat-Snake.

Local name.—None.

[1] Alcock and Rogers (*Proc. Roy. Soc.*, vol. lxx, p. 1902) quoted in the *Journ. Bom. Nat. Hist. Soc.* 'Non-Poisonous Snakes' by S. H. Prater, vol. xxxvi, No. 2, p. 393.

[2] 'Animaux venimeux et Venins' by Mme Phisalix, 1922. Tome II, p. 394.

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It is generally believed by the local inhabitants that this snake is a female Cobra.

Exoskeleton. It is more slender than *Ptyas mucosus* and shows a proportionate rounded thickness for the length attained. The size of the head is small. The neck is distinct and the cervical region slender. The rest of the body is uniformly rounded and thick. The tail is moderately tapering. There is dorsally and centrally in the long axis of the body a furrow running from the neck to a little short of a point above the vent.

Scale formation.—There are large head shields. The supralabials number 8; the first and second touch the nasals; the fourth and fifth the eye; and the sixth and seventh the temporal shields. The fifth supralabial is very large and reaches up to behind the eye. There is only one loreal. There are 3 praeoculars and 2 postoculars. The costal scales are retiform, imbricated, and longer than broad, not keeled; they numbered 22, 22, 27 (male specimen), and 23, 23, 17 (female specimen), in the anterior, middle and posterior third of the body. The ventral plates completely spanned the belly and numbered 213 in the male and 223 in the female. The anal shield is divided into two sections. The subcaudals numbered 91 in the male and 77 in the female and were divided throughout.

Colour.—The female was of a uniform dark brown shade. The male was a rich light brown. In both specimens the under-surface of the neck was a creamy yellow—as also the infralabials and supralabials. The belly was white.

Eye.—This was moderately large. The pupil spherical. The nares were laterally placed.

Endoskeleton.—The skull is nearly ovate in formation. The intermaxillary is small, dorsally convexed and placed between the maxillary bones. The nasal bones are very large, dorsally convexed and suturally united with the frontals and praefrontals. The praefrontals are nearly square wedges of bone suturally united with the frontals. The frontals are short and narrow. The parietals are fairly long and broad and slightly rounded on the dorsal aspect. The squamosals are comparatively short, thin bony plates. The quadrate is short, moderately spatulate above and laterally smooth. The ectopterygoid is thin, flat and articulates at almost a right angle with the maxillary bone. The pterygoid is moderately broad behind and shows slight, if any, grooving on the ventral surface; it touches the mandible. The maxillary bones are anteriorly broad, posteriorly thin and laterally convexed. The mandibles are posteriorly moderately broad. The dentary is slightly less than half the length of the articular ramus. The mandible in its length is ventrally convexed. The palatines are long.

Vertebrae.—The neural spines are large and square plates. The hypapophyses are well developed in the cervical region and diminish in size in the thoracic vertebrae; in the dorsal vertebrae they are absent.

Ribs.—These are small in the cervical vertebrae and large and of uniform length in the rest of the body except in the dorsal vertebrae where they diminish in length. The free ends are pointed.

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Locomotion.—This has not been observed.

Dentition.—The maxillary teeth number 12; the anterior and middle are slightly larger than the posterior ones. The palatine teeth number 9; they are of uniform length. The pterygoids have 14 teeth, equal in length to those of the palatines. The dentary shows a peculiar arrangement; the teeth are set in three lots numbering altogether 14; the first consists of 6 teeth of nearly uniform length, the second of 2 teeth which are the longest, the third of 6 teeth equal to and uniform in length with those placed anteriorly.

Gland structures.—Is provided with a large parotid gland. The toxicity of the secretion has not been investigated.

Habitat.—Ceylon and Peninsular India up to the base of the Himalayas (Wall).

Note:—This is a rare snake in Deolali—only 2 specimens were secured, a male and a female. The male measured 36 in. and the female 47 in. The details as to a sexual association have been earlier referred to. The female was gravid and contained 5 eggs in an early state of development.

Species: **Coluber helena** (Daud.). The Trinket Snake.

Local name.—None.

Exoskeleton.—The snout is obtusely rounded. The head is elongated and flat. The neck is distinct. The body is slightly compressed anteriorly, the rest is of uniform rounded thickness. The tail is moderately tapering.

Scale formation.—There are large head shields present. The supralabials number 10 to 11; the first and second touch the nasals; the fifth, sixth and seventh touch the eye; and the eighth and ninth the temporal shields. The costal scales are retiform, longer than broad, and show apical facets, not keeled; they number 19-25, 22-27, 19-20, in the anterior, middle and posterior third of the body respectively. There is only one loreal. There are 1 praeocular and 2 postoculars. The ventral plates number from 168 to 264 and stretch completely across the belly. The anal shield is entire. The subcaudals are divided throughout and number from 81 to 88. The naris is laterally placed. The eye is large; iris golden, pupil spherical.

Colour.—This snake at first sight bears a colour resemblance to *Rhabdophis stolatus* and in this respect can be easily confused with it. Anteriorly the head is a deep brown, sometimes with a greenish tinge. The supralabials are white. Posteriorly the head and nape are a light pinkish brown. On the nape dorsally and also laterally are black linear streaks running in the long axis. The anterior third of the body shows at intervals 5 to 6 series of broad black bands interspersed with white stippling laid on a background of light pinkish brown. A portion of the middle third of the body is irregularly mottled white, black and brown. The remaining portion of the body shows three series of broad lines laid in the long axis; the intermediate dorsal band is a light brown and those laterally placed are a very dark brown; all of these end on the tail. The belly is white and sometimes faintly tinged with yellow.

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Length.—The smallest measured 2 ft. 8 in.—the largest 3 ft. 9 in. This latter one was a gravid female.

Endoskeleton.—The anterior portion of the skull is twice the length of the posterior section. It is ovate in formation. The intermaxillary is free and placed forward in front of the maxillary. The nasals are large and long and the division between them and the praefrontals is very constricted. The praefrontals are specifically large, thick, rectangular in form and suturally united with the frontals; anteriorly they are extended into small processes lying with the nasals. The frontals are long and narrow. The parietals are short in the form of a shield and the posterior portion is extended into a thin, long spicule terminating in a point laid over the supraoccipital. The squamosals are thin, flat and long. The quadrate is superiorly broad and anteriorly rounded; inferiorly it is a long and thin rod of bone. The posterior articular part of the mandible is very broadly formed and notched. The dentary section is thin and long. The ectopterygoid is short, flat and thick. The maxillary bones are thin, narrow, long and curved in the middle portion to form a concavity fitting the convexity of the praefrontals which articulate with them. The pterygoid is posteriorly broadly formed, ventrally grooved and touches the mandible. The palatine bones are long. The postfrontal zygoma is broad and thick. The supra and exoccipital show depressions.

Dentition.—All the teeth are solid and slightly recurved. There are no grooved or perforated fangs. The maxillary has 13 teeth, which are large and of uniform length. The palatine has 7 teeth of a moderately large and uniform character. The pterygoid is provided with 14 teeth; all of them small and of uniform size. The dentary has 18 teeth; the anterior series are very large and the posterior ones diminish in size. There are reserve teeth in two rows on the inner aspect of the maxillaries and on the outer or maxillary side of the palatines and pterygoids.

Vertebrae.—The neural spines are large squared plate-like extensions. The hypapophyses are large in the cervical vertebrae and from thence diminish in size gradually up to the last thoracic vertebra. The dorsal vertebrae show no hypapophyses.

Ribs.—The free ends are pointed In the anterior third of the body they are shorter than in the rest of the body.

Locomotion.—A fairly active snake and moving with a fair degree of speed. The spiral curves are like those of *Lycodon aulicus*.

Gland structures.—This snake has no parotid gland. There is a gland close to the eye behind the postfrontal zygoma in the temporal region. Col. Gharpurey (1932)[1] reported the instance of a woman who was bitten on the forearm by one of this species. The whole forearm was swollen as far as the elbow. There were no after-effects.

Habitat.—Peninsular India including the Himalayas, Ceylon (Wall).

[1] 'Cases of Snake Bite' by Lt.-Col. K. G. Gharpurey, I.M.S., *Journ. Bom. Nat. Hist. Soc.*, vol. xxxvi, No. 1, dated 15-11-1932, p. 272. Case No. 1.

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Note:—An uncommon species in Deolali. The few that were met with appeared during the rains. One was found in the roof of a building under repair.

A gravid female was found to contain 10 eggs in an early stage of development.

Species: **Oligodon arnensis** (Shaw.) The Banded Kukri Snake.

Local name.—None. .

Exoskeleton.—The formation is rounded and of a uniform slenderness throughout. The snout is pointed. The head is small and slightly ovate. The neck is slightly demarcated. The anterior third of the body is more slender than the posterior two-thirds. The tail is moderately tapering.

Scale formation.—There are head shields present. The costal scales are juxtaposed and longer than broad. There is no keeling. The supralabials number 7; the first and second touch the nasals, the third and fourth touch the eye and the fifth and sixth the temporal shields, the fourth is the largest. There are 1 praeocular and 2 postoculars. The costal scales number 17, 17, 13-15, in the anterior, middle and posterior third of the body. The ventral plates number 180 to 198 and stretch completely across the belly. The anal shield is divided into 2 sections. The subcaudals are divided throughout and number from 49 to 56.

Length.—The largest measured 1 ft. 10½ in. and the smallest 1 ft.

Colour.—The head is dark brown with a black chevron in evidence. Posterior to this is a lighter brown chevron and behind this again on the nape is another broader angular band of dark brown edged with white. From the neck to the tip of the tail at regular intervals are dark brown and in some reddish brown ovately broad bands edged with white and set on a background of grey or greeny grey. These bands diminish in width and fade into perceptible lines over the tail. The belly in the adult is white and in the young a pale yellow.

Eye.—This is small and the pupil spherical.

Endoskeleton.—Dorsally viewed the skull is triangular in front and semi-ovate behind. The intermaxillary is moderate broad, rounded and overlapped by the maxillary. The nasals are large for the size of the head and the division between them and the frontals indistinct. The praefrontals show a peculiarity in consisting of two pieces suturally united with each other and with the frontals. The frontal bones are broad and short. The parietals are ovately broad and dorsally convexed. The squamosals are fairly short, thin and flat. The quadrate is superiorly spatulate in a somewhat irregular form and inferiorly connected with the mandible by a slender rod of bone. The temporal region is large and bulges laterally. The ecto-pterygoid is particularly large in contrast with the smallness of the species. The maxillary bones are long and broad especially in the posterior half. The pterygoids are posteriorly broad, ventrally grooved and touch the mandibles. The palatines are short. The articular end of the mandible is lightly formed and notched. The dentary is slender and along with the ramus forms a convexity on the ventral surface.

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Dentition.—There are no grooved or perforated fangs—all the teeth are solid. The maxillary teeth number 9; the posterior ones are large. The palatine teeth number 6 and are small and uniform in size. The pterygoid is set with 6 teeth, uniform and of the same size as the palatine teeth. They end near to the point where the ecto-pterygoid rests in an articular union. The dentary has 12 teeth, those in the middle are slightly larger.

Ribs.—The free ends are pointed. Those in the middle and posterior third of the body are uniform in length. The anterior ribs of the body are slightly smaller in length.

Locomotion.—The spiral motion is like that of *Lycodon aulicus*.

Vertebrae.—The neural spines are small squared plates. The hypapophyses are well formed in the cervical vertebrae. In the thoracic vertebrae they diminish in size and are absent in the dorsal vertebrae.

Gland structure.—This species has a very small parotid gland. According to the experiments carried out by Mme Phisalix and Caius (1922) the secretion from it produces death in small birds.

Habitat.—Peninsular India including the Himalayas, Ceylon (Wall).

Note:—This species is uncommon in Deolali, appearing just before and during the rains. Does not show any temper, and will not attempt to bite even when extremely provoked. The longest measured 1 ft. 10½ in. and the smallest 1 ft. The nares are placed laterally.

Species: **Oligodon taeniolatus subgriseus** (Jerd.) The Variegated Kukri Snake.

Local name.—None.

Exoskeleton.—The formation is slender throughout. The snout is moderately pointed. The head is large in contrast with the body. The neck is slightly demarcated. The body is rounded and of uniform thickness except in the middle third which is slightly larger. The tail is short and moderately tapering.

Scale formation.—There are head shields present. The supralabials number 7; the first and second touch the nasals, the third and fourth touch the eye, and the fifth and sixth the temporal shields. There is one loreal. The praeoculars number 2, and the postoculars 3. The costal scales are retiform and as long as broad; they number 15, 15, 15, in the anterior, middle and posterior third of the body respectively. The ventral plates stretch across the belly and number from 175 to 200. The anal shield is divided into 2 sections. The subcaudals are divided throughout and number from 42 to 56.

Colour.—There is a dark brown band on the head anteriorly and running backwards from this is a linear streak of the same colour, which joins a dark brown chevron collar laid over the nape and around the jaws laterally. Above the eyes are small black linear streaks. Along the body on a background of straw are irregular striations in dark brown or black. These recur at regular intervals and extend over the caudal area where they are less conspicuous. The belly is white.

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Length.—The largest measured 1 ft. 4 in. and the smallest 5½ in. The naris is placed laterally.

Eye.—The eye is large for the smallness of this species and the pupil is spherical.

Endoskeleton.—The skull is ovate in formation. The nasals are fairly large in contrast with the small size of the skull and are oval in shape. The intermaxillary is pointed and placed anterior to the maxillary. The frontals are broad and overlap the praefrontals, which are slender strips of bone placed in a perpendicular position over the maxillaries, and are suturally united with the frontals. The parietals are slightly rounded and large. The temporals bulge laterally. The squamosals are short, thin and flat. The quadrate is moderately spatulate above, laterally notched and long in comparison with the size of the skull. The palatines are long. The pterygoids are narrow, slightly grooved on the ventral aspect and touch the mandibles. The maxillary is thin and moderately long. The articular end of the mandible is thinly formed and longer than the dentary, which is short and slender. The ectopterygoid is short and flat.

Dentition.—There are no grooved or perforated fangs. All the teeth are solid. Only the maxillary and dentary are toothed; the palatines and pterygoids are devoid of teeth. The maxillary teeth number 6; all unusually large and out of all proportion to the small-sized skull; the posterior ones are the longest. The dentary teeth number 9, they are comparatively smaller and the anterior are the longest.

Vertebrae.—The neural spines are small squared plates. The hypapophyses are well formed in the cervical vertebrae and diminish in size in the thoracic series. In the dorsal vertebrae they are absent.

Ribs.—The ends are pointed. They are of a uniform small length throughout the body.

Locomotion.—Like that of *Lycodon aulicus.*

Gland structure.—A very small parotid. The secretion, as shown by Mme Phisalix and Caius, is toxic to small birds without, however, killing them.

Habitat.—Peninsular India including the Himalayas, Ceylon (Wall).

Note :—Appears just before and during the rains. It is an uncommon species in Deolali. Mention has been made of a burrowing quality it exhibits. It can be provoked to bite, but is not bad tempered.

SUB-FAMILY: DIPSADINÆ. *'Opisthoglypha'*

Species: **Dipsadomorphus trigonatus** (Schn.) The Common Cat Snake.

Local name : None.

Exoskeleton.—The snout is moderately pointed. The head is large, flat and ovate in shape. The jaws are prominent. The neck is slender and well defined. Anteriorly the body is slender and gradually thickens towards the middle third. It is then of

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uniform thickness till about the vent. The tail is long and tapering. Dorsally the back is distinctly ridged and laterally compressed. The ventral portion of the body is broad. A section of the body would appear ovately triangular.

Scale formation.—There are fairly large head shields. The supralabials number 8; the first and second touch the nasals; the third, fourth and fifth touch the eye; and the sixth and seventh the temporal shields, the sixth and seventh are the largest. There is one loreal. The praeoculars number 2 and the postoculars 2. The ventral plates stretch across the belly and number from 225 to 245. The anal shield is entire. The subcaudals are divided throughout and number from 74 to 90. Dorsally the vertebral scales in the long axis of the body are enlarged, particularly those in the posterior third of the body. The costal scales are imbricated and much longer than broad; they number 21, 21, 15, in the anterior, middle and posterior third of the body.

Colour.—The background is a dark khaki. The head is black with the imprint of an inverted Y upon it. From above and behind the eye are white linear streaks. A series of irregular chevron-like and confluent white striations at intervals lie along the back. These fade towards the tail. The belly is white and each alternate ventral plate at its costal margin is spotted black.

Length.—The largest measured 2 ft. 9 in. and the smallest 6 in. The naris is placed laterally. The eye is large, the iris black and the pupil vertical.

Endoskeleton.—The skull is ovate in shape. The intermaxillary lies directly between the maxillary bones. The nasals are large and triangular in shape. The frontals are short and broad. The praefrontals are suturally united with the frontals and are broad bony pieces arched forwards and downwards and wider at the articular end placed upon the maxillaries. The parietals are moderately large and the posterior termination is overlapped by the supraoccipital, which is in the shape of a bisected collar. The squamosals are thin, medium-sized, flat bones. The quadrate is superiorly spatulate and long and rod-like inferiorly. The ectopterygoid is short, flat and thick. The pterygoid is moderately broad, ventrally grooved and touches the mandible. The mandibles at their articular ends are moderately broad and notched. The dentary is long, slightly thick and broader posteriorly. The palatines are short. The maxillary bones are long and thin. They show on the superior border an anterior convexity and behind this two concave portions—the first of these is long and slightly concave, while the second is deeply concave.

Dentition.—This snake is opisthoglyphous. The maxillary has 10 teeth; the last pair set posteriorly and apart are recurved fangs, large and grooved on the anterior surface; those placed in the forward position are solid and slightly shorter with the points directed inwards. The palatine teeth number 5, they are solid and of uniform length and smaller than the maxillary teeth. The pterygoids have 7 teeth equal in length to the palatine series. The dentary is set with 12 solid teeth, all fairly large, but those placed in the forward position longest.

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Vertebrae.—The neural spines are small squared plates. The hypapophyses are well formed in the cervical vertebrae. They decrease in size in the thoracic series and are absent in the dorsal vertebrae.

Ribs.—In consonance with the body formation—the ribs in the cervical section are smaller and gradually increase in length until about the middle third of the body. There is then a proportionate decrease up to the vent. The free ends are pointed.

Locomotion.—The same as in *Lycodon aulicus.*

Gland structure.—This species and *Dryophis mycterizans* of the same sub-family are equipped with a parotid gland, which in structure appears differently constituted from that of the aglypha having a gland in the same position in the head. In this snake the gland is tough, flat, shotty to the feel and of a yellow colour, whereas the gland in the aglypha is a large, white, lobulated mass. In addition to the parotid gland there is another smaller bilobed gland situated in the temporal region behind the postfrontal zygoma and close to the eye; the duct from it passes under the eye to the maxillary bone. Alcock and Rogers (1901) reported on the venomous properties of the saliva of this species. It is undoubtedly toxic and lethal for lizards (*Calotes versicolor*). Mme Phisalix and Caius have found it highly toxic to the mouse.

Habitat.—Peninsular India including the Himalayas, Ceylon (Wall).

Note :—A fairly common snake in Deolali. Is in evidence throughout the year, but appears in greater numbers during the rains. One gravid female was found to contain 9 eggs. These were elongated in form and showed variations in the length.

This species is bad tempered. It is very easily provoked to bite. Once its temper is aroused it shows its rage by forming the anterior third of its body into a figure of eight and with the head erected and ready to dart it waits impatiently vibrating the tail.

Species: **Dryophis mycterizans** (Linn.) The Green Whip Snake.

Local name.—Because of its green colour it is called 'Hira Samp' or green snake.

There was only one specimen secured and examined.

Exoskeleton.—The formation is characteristically slender throughout. The snout is markedly protruded into a long fine point. The head is rounded dorsally, laterally compressed and elongated. The anterior portion of the body is very slender and there is no distinction or constriction denoting the neck. The rest of the body is thicker but the slender proportions are maintained. Dorsally the body is ridged and laterally compressed. The tail is particularly long and whip-like and rather rounded than compressed.

Scale formation.—There are head shields of an elongated form in correspondence with the head formation. The rostral shield is specifically long and pointed. The supralabials number 8; the first touches the nasal, the fourth and fifth touch the eye (it should be noted that the fourth is divided into three parts of which the

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two uppermost touch the eye), the sixth and seventh touch the temporal shields. There are 1 praeocular and 2 postoculars. The costal scales in the middle and posterior third of the body are rounded and as long as broad; those in the anterior part of the body are imbricated and much longer than broad. The central dorsal scales along the back are enlarged. There is no keeling in evidence. The costal scales numbered 15, 16, 13, in the anterior, middle and posterior third of the body. The ventral plates stretched across the belly and numbered 185. The anal shield is divided into 2 sections. The subcaudals were divided throughout and numbered 139.

Colour.—This was a foliage green throughout. Two yellow lines ran the whole length laterally and in the long axis of the body. The supralabials were yellowish green. The undersurface of the neck was white and the belly green. The specimen measured 3 ft. 10 in. in length.

The eye was small and the pupil horizontal. The naris was laterally placed.

Endoskeleton.—The skull is elongated. The intermaxillary is broad posteriorly and anteriorly projected to a fine point; it lies between the maxillary bones. The nasals are particularly enlarged and ovately elongated; the division between them and the frontals and praefrontals is narrow. The praefrontals are large and triangular in shape with the apex projected forward. The frontals are short and narrow and suturally united with the praefrontals. The parietals are long and the posterior end is attenuated and laid over the supraoccipital which shows two depressions. The squamosals are thin and long and shaped like a boomerang. The quadrate is long and broadly curved and notched; it is anteriorly and inferiorly concave and posteriorly and superiorly convexed. The maxillary bones show two sections joined together by a thin bridge of bone; the anterior section is broad and the posterior one thin. The ectopterygoid is short, thick and flat. The palatines are short. The pterygoid is broadly formed posteriorly, ventrally grooved and touches the mandible. The articular end of the mandible is broadly fashioned, winged and notched. The dentary section is clubbed anteriorly.

Dentition.—Owing to the formation of the maxillary bone the teeth set in it are in two lots; the anterior series number 7, of which the posterior ones are large; the second lot number 7 and here the last two are large, recurved and grooved on the anterior surfaces. The palatines have 6 solid teeth; the anterior ones are large. The pterygoid teeth number 19; those set anteriorly and towards the middle are larger than the posterior ones. The dentary like the maxillary because of its formation shows a peculiar arrangement; the peculiarity here is a close copy of the setting seen in the dentary of *Lycodon aulicus*. To the thicker or clubbed end of the bone are fixed 4 large recurved solid teeth; the two anteriorly set are shorter than the succeeding pair which are well developed; there is then a gap followed by a second series of smaller teeth numbering 16, of which the first 4 are long and the rest of small and uniform length.

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Vertebrae.—In keeping with the slender make-up of the body, the vertebrae show a long and narrow formation, and the dorso-ventral diameter is short. As has been previously mentioned in this paper, the first cervical is ½ a millimetre larger than the second. The succeeding vertebrae gradually increase in size, until the anterior dorsal vertebrae are reached, where the maximum depth, width and length is attained. The measurements are 5 mm. and 7 mm. dorso-ventrally and antero-posteriorly respectively, as compared with the largest dorsal vertebra of *Ptyas mucosus* which measures 11 mm. in both directions. Thereafter the vertebrae correspondingly gradually decrease. The neural spines are short dorso-ventrally and very long. They are squared plate-like extensions. The hypapophyses are well developed in the cervical region and gradually diminish in size in the thoracic section. In the dorsal division they are absent. The caudal vertebrae are very numerous and structurally delicate.

Ribs.—The free ends are pointed. The formation is slender, both in length and thickness. They are shorter in the cervical section and slightly longer and of uniform length in the rest of the body, except posteriorly in the dorsal vertebrae, where they decrease in size.

Gland structure.—Same as in *Dipsadomorphus trigonatus*. Alcock and Rogers (1902) showed the saliva to be toxic to the mouse. Later Mme Phisalix and Caius (1918) confirmed those results and found moreover that the saliva was also toxic to small birds and to toads. Mr. McCann (April 1934)[1] graphically describes the incident of one of those snakes feeding on a lizard and mentions the convulsions noted in the lizard as a result of the venom injected. He also claims to have been bitten by one of them without any ill effects ensuing.

Habitat.—Peninsular India, excluding the valley west of Patna, Ceylon, Siam, Indo-China (Wall).

Note:—The specimen secured here is apparently a half-grown snake, as the example quoted by Mr. Prater (1926)[2] (Bombay, F. Birkett) measured 6 ft. 11 in. It is a rare snake in Deolali and was secured by Mr. Fenton-Bailie. The slender formation, leaf-shaped head and green colour are adaptations admirably suited to an arboreal existence.

Sub-Family: Elapinae *Proteroglypha.*

Species: **Bungarus caeruleus** (Schn.) The Common Krait.

Local name: 'Cowrieala' because of the colour resemblance to a variety of sea shell.

Exoskeleton.—The formation presents a nearly uniform thickness throughout. The snout is rounded. The head is large and

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[1] 'A Whip-Snake feeding on the Lizard', by C. McMann, F.L.S., *Journ. Bom. Nat. Hist. Soc.*, vol. xxxvii, No. 1, p. 226.

[2] 'The Snakes of Bombay Island and Salsette' by S. H. Prater, C.M.Z.S. April 1926, p. 28. Reprint from *Journ. Bom. Nat. Hist. Soc.*, vol. xxx, No. 1.

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of a proportionate size to the body. The neck is distinct. The body is uniformly thick and the tail is moderately tapering.

Scale formation.—There are large head shields. The costal scales are retiform and rounded. The dorsal scales centrally along the back are enlarged and hexagonal, a specific character. In young specimens 10 to 12 inches long, the large scales on the back begin at a point about two head lengths away from the head; those in the middle third of the body are the largest. The supralabials number 8; the first and second touch the nasals, the third and fourth touch the eye, and the seventh and eighth the temporal shields; in one example the fourth, fifth and sixth touched the eye. There is no loreal. There are 1 praeocular and 2 post-oculars. The costal scales number 15, 15, 15, in the anterior, middle and posterior third of the body. The ventral plates are large and stretch across the belly and number from 216 to 222. The anal shield is entire. The subcaudals are undivided throughout and number from 48 to 52.

Colour.—The head and background of the body are uniformly black, but some young specimens show up as dark brown. Dorsally and centrally along the back at short regular intervals are white spots and laterally uprising from the ventral margins are transverse linear white rings nearly meeting the aforementioned spots; the white rings are more prominent posteriorly. The belly is white. Specimens immersed in spirit over long periods of time change to a bluey black.

The eye is large and the pupil spherical. The nares are laterally placed.

Length.—The largest measured 3 ft. 10 in. and the smallest 10 in.

Endoskeleton.—The skull is elongated and slightly narrow in form. The anterior portion is heavily built and short, while the posterior section is much longer. The intermaxillary is convexed anteriorly and widely separated from the maxillary bones. The nasal bones are wide and long. The frontals are thick, short and dorsally convexed. The praefrontals are anteriorly and laterally convexed; they are thick and narrow above where there are sutures dividing them from the frontals, and broadly formed inferiorly at their convexed articular junction with the maxillaries. The parietals are triangular and long, terminating behind in a thin point crossing and laid over the supraoccipital crest. The temporals are large and bulging in character. The squamosals are particularly slender, thin, flat and short in contrast with the general heavy formation of the skull bones. The quadrate is very short, thick and spatulate above. The maxillary bones are thick, short and strongly built; they are broad in front, superiorly concave and laterally and inferiorly convexed; on the inner ventral aspect they are concave. The ectopterygoid is anteriorly thick and strongly fashioned, having a spatulate form at the articular end laid over the maxillary, posteriorly it is long and thins down to the point articulating with the pterygoid. The pterygoid, posteriorly, is moderately broad, ventrally grooved and touches the mandibles. The palatines are long. The basioccipital is ridged.

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The mandibles are stoutly built, being of nearly equal thickness throughout their length, the posterior part is notched and is slightly broader than the anterior or dentary portion.

Dentition.—The maxillary bones have two moderately developed, canaliculated, recurved fangs anteriorly set. The apertures of these fangs are placed on the anterior surface a little above their sharp points. There is then a gap in the bone, followed by a group of 4 solid teeth. These are small and of uniform length. The palatine teeth number 7, they are solid and of uniform size, but slightly smaller than the solid teeth set in the maxillary bones. The pterygoids have 12 solid teeth, equal in size to those of the palatines. The dentary is provided with 18 to 20 solid teeth; those anteriorly placed are large and the teeth diminish in size from before backwards.

Vertebrae.—The chief specific character is the winged extensions or alae projected laterally on either side of the neural arches. In this respect this species is unique and unlike any of the other in Deolali. The neural spines are large squared plate-like extensions. The hypapophyses are well developed throughout, but gradually diminish in size from before backwards. Another distinguishing feature is the marked wing-like formation of the rib-like processes fused with the bodies of the cloacal and caudal vertebrae, two such in the former and one in the latter on either side of the vertebrae.

Ribs.—These, in conformity with the rounded thickness of the body are of nearly uniform length. They are stoutly formed and the free ends are blunted.

Locomotion.—This has not been observed.

Habitat.—Ceylon, Peninsular India, including the Himalayas up to 5,000 ft. (Wall).

Note:—This species probably exists in greater numbers than were actually found. It can be considered as fairly common in Deolali. It may be remarked that the young krait is less often a dark brown in its colour background, hence it is that young and sub-adult specimens of *Lycodon aulicus* because of a like colour and part design presentation, are often mistaken for this species by those who are unacquainted with the other specific characters which distinguish them. No specimens were found with the alimentary canal containing an ingested meal. They are said to feed on rats and are threfore frequently met with near to and in human habitations. Little is known as to their habits. Other workers have found this species to be inoffensive and not prone to bite, even when greatly provoked. The fatalities recorded from bites of Kraits, however, show that they in common with most other animals have limitations placed upon their patience. The fact that they have a potent venom provision and canaliculated fangs in itself points to some aggressive quality.

Species: **Naia naia,** *var.* **caeca** (Merr.).
Naia tripudians (Merr.). The Binocellate Cobra

Local name.—*'Nag'.*

Exoskeleton.—The head is flat and slightly elongated. There

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is no neck division, rather this region is dilatable and in the erected state the cervical division is indicated by an expanded hood. The body is dorsally ridged and laterally slightly compressed; it is anteriorly well developed and diminishes in thickness from before backwards. The tail is cylindrical and tapering.

Scale formation.—The costal scales are imbricated, longer than broad and longest in the anterior part of the body. There are large head shields. The supralabials number 7; the first, second and third touch the nasals; the third and fourth touch the eye; and the fifth and sixth the temporal shields; the third is the largest. There is no loreal. The one praeocular touches the nasals, and there are 2 postoculars. There is an important specific peculiarity in the presence of a cuneate scale—sometimes 2—wedged in above the fourth and fifth infralabials. The costal scales vary in the counts from 19, 20, 13, to 29, 25, 16, in the anterior, middle and posterior third of the body. Col. Wall (1928)[1] has emphasised the peculiar formation of the costal scales; these show a concavity at the posterior junction of each row and the next. The ventral plates stretch completely across the belly and number from 188 to 199. The anal shield is entire. The subcaudals are divided throughout and number from 52 to 65.

Colour.—Varies in shade—black, brown, straw or buff. There are markings of black and white in the shape of spectacles (binocellate) on the hood. The belly is white and anteriorly on the ventral aspect of the hood there are black bands and some spots.

Length.—The longest measured 4 ft. 8½ in. and the smallest 7 in. The eye is large and the pupil spherical.

Endoskeleton.—The general presentation is a symmetry and lightness in the formation of the head bones. Anteriorly the skull is trefoil in shape and posteriorly it is narrow and squared. The intermaxillary is specifically large; it is dorsally and anteriorly convexed and projected beyond and separated from the maxillary bone. The nasals are large and suturally divided. The praefrontals are thin, narrow, convexed strips of bone projected downwards and suturally united with the frontals above; they are notched on the anterior and inferior border on the inner side and the division between them and the nasals is slight. The frontals are short and broad. The parietals are equilaterally triangular with the apex placed over the supraoccipital. The temporals are well developed and bulge laterally. The supraoccipital is circularly ridged in the form of a crest. The maxillary bones are broadly formed anteriorly, and they posteriorly thin down, they are laterally convexed and ventrally and dorsally concave. The ectopterygoids are thin, long, flat, narrow and laterally convex; the articular end laid on the maxillary bone is slightly spatulate. The palatines are short. The pterygoids are posteriorly moderately broad, ventrally grooved and touch the mandibles. The squamosals are short, thick and flat. The quadrate is long, broadly spatulate above, anteriorly extended and laterally notched. The mandibles are comparatively

[1] 'The Poisonous Terrestrial Snakes of our British Indian Dominions etc. etc.' by Col. F. Wall, I.M.S., K.H.S., C.M.Z.S., 1928, p. 26.

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slender in formation; the posterior articular end is moderately broad and notched. The dentary portion is short and slender.

Dentition.—The maxillary bones show the proteroglyphous fangs, two in number, one operative and the other held in reserve, fixed to the broadly formed anterior portion of the bone. Both these fangs are canaliculated and the aperture for the exit of the poison is placed anteriorly and superiorly above the fang points. Below these fangs and on the inner and concave portions of the maxillary bones is one small solid tooth. In the lateral view the reserve poison fang is not visible, as it is in the recumbent position bent in on the ventral concavity of the maxillary. The palatines have 5 solid teeth; those anteriorly placed are larger. The pterygoids are set with 11 to 12 solid teeth of uniform length. The dentary has 12 solid teeth; those in the forward position are large and recurved and the teeth diminish in size from before backwards.

Vertebrae.—The neural spines are small and nearly square plates. The hypapophyses are well formed in the cervical section and they gradually diminish in size until the last dorsal vertebra in which it is considerably reduced.

Ribs.—The cervical region shows the longest ribs in the section corresponding to the hood. From thence the ribs decrease in length from before backwards. The free ends are pointed.

Locomotion.—A fairly fast-moving snake. There is a slightly more wavy side to side swing than in *Ptyas mucosus*.

Gland structure.—This is so well known that it scarcely requires any description. There is a large aciniform gland between the eye and the angle of the mouth. It secretes a potent venom in any quantity up to 1 c.c. Lamb's estimate (quoted by Col. Wall, 1928),[1] of the number of bitten subjects who escape with a sub-lethal dose is put at 30 per cent. It is one of our deadly venomous snakes.

Habitat.—Ceylon, Peninsular India, including the Himalayas up to 5,000 ft., Burma (Wall).

Note:—It is fairly common in Deolali. In evidence at most times of the year, but more especially during the rains.

It is not vindictive and will not go out of its way to attack. Its first desire is to effect escape but if molested it will face the tormentor. It then at once assumes the defensive by erecting the head, expanding the hood and watching one's every movement, awaiting an opportunity to bite and further intimidating by hissing. It is because of this behaviour that it is easily caught and killed.

Species: **Callophis trimaculatus** (Daud.) The Slender Coral Snake.

Local name.—None.

Exoskeleton.—The formation is slender throughout. The neck is not demarcated. The body is uniformly rounded and slender. The tail is short and abruptly terminates in a point.

[1] 'The Poisonous Terrestrial Snakes of our British Indian Dominions, etc.' by Col. F. Wall, I.M.S., K.H.S., C.M.Z.S., 1928, p. 75.

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Scale formation.—There are small head shields. The supralabials number 6; the first and second touch the nasals; the third and fourth touch the eye; and the fifth and sixth the temporal shields; the third is the largest of the series. There are one praeocular and two postoculars. The costal scales are smooth, as long as broad and diamond-shaped; they number 13, 13, 13, in the anterior, middle and posterior third of the body. The ventrals stretch across the belly and number from 250 to 272. The anal shield is divided into two sections. The subcaudals are divided throughout and number from 26 to 32.

Colour.—Head tarry black, and speckled white as follows:—One large white spot on each temporal shield. There are 4 white scales behind the parietal shields. The black markings are edged with white and laterally run in scolloped edges on to the neck and side of upper and lower jaw. The body is uniformly buff or yellowish brown. Dorsally, on the tail and a little short of its tip, is a black irregular band edged with white. About one inch anteriorly to this is another similar and slightly larger black band also edged with white. The belly is a coral pink up to the vent. The subcaudals are white with black irregular markings.

The eye is small—pupil spherical, iris black. The nares are laterally placed.

Endoskeleton.—The skull is elongated. The anterior portion of it is broader than the posterior section. The intermaxillary is projected forwards and away from the maxillary. The nasals are as large as the frontals, and both are suturally divided. The praefrontals are thin, circular, arched strips of bone continued over the orbit and fused with the postfrontals behind; they are suturally divided from the frontals. The parietals are large and rounded and show no division; the original suture is seen in young specimens 9 inches long. The temporals are as long as the parietals. There are no squamosal bones. There is a fused irregular mass in the shape of a rounded portuberance placed over the mastoid region which shows no distinction as between a true, separate squamosal and mastoid eminence. Upon a smooth surface of this projected mass the quadrate articulates. The quadrate is superiorly spatulate and projected backwards, it is of proportionate length with the size of the skull. The maxillary bones are short, thick and well developed for so small a skull; they are thicker anteriorly, and posteriorly thin and notched. The anterior end of the ectopterygoid is adapted to fit the notched end of the maxillary and is firmly wedged to it. The ectopterygoid is thin and long and forms the base of the orbit. The turbinal bones are thick and show a heavy formation. The palatines are short. The pterygoids are thin, long strips of bone and of a uniform character throughout without any ventral grooving; they touch the mandible. The mandibles are thinly formed and the ramus portion is roughly four times longer than the dentary section.

Dentition.—To the maxillary bones in their anterior portions are set two small, recurved and canaliculated fangs. One is operative and the other held in reserve. The reserve fang is recumbent and bent in on the ventral aspects of the maxillary

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bones. It is not generally seen in a lateral view. The apertures of the fangs, as is usual with the proteroglypha, are anteriorly and superiorly positioned above the fang points. The palatines have three small, solid teeth, while the pterygoids are devoid of them. The dentary has 2 solid teeth set widely apart.

Vertebrae.—The vertebrae are small and delicately formed. There are no neural spines. The hypapophyses are proportionately long and gradually diminish in size up to the last dorsal vertebra.

Ribs.—The free ends are pointed. They are slender in formation and of nearly uniform length throughout.

Locomotion.—The spiral curves are deep and like those depicted for the Russell's Viper.

Gland structures.—A small aciniform gland situated in the temporal region, behind and away from the eye. Nothing is known as to the poisonous properties of the venom. Although built on very small and delicate lines this species falls into the Thanatophidia, because of the anatomical similarity of its venom gland and the presence of perforated fangs. The quantity of venom secreted must necessarily be small in amount. The point as to whether it is capable of injecting a lethal dose has not been ascertained.

Habitat.—Ceylon, India: South Deccan, Kanara and Bengal (Wall).

Note:—This species is uncommon in Deolali. When touched they behave in a peculiar way by erecting and rolling up the caudal section dorsally into a ringed formation. In doing this the coral and black and white stained surfaces of the belly and subcaudals become exposed. This trait is probably an intimidatory effort to stay further molestation. What exactly they feed upon has not been ascertained. The thinly delicate formation of the body and the smallness of the head with few small teeth in it precludes any capacity for seizing and swallowing larger living things than centipedes, millipedes and insects.

Family: Viperidæ.

Sub-Family: Viperinæ.

Species: **Vipera russelli** (Shaw.) The Russell's Viper.

Local name.—None exists—probably due to the fact it is rare in these parts and seldom seen.

Exoskeleton.—Shows a massive formation throughout. The head is large, flat and triangular. The muscular development around the jaws is a marked feature. The neck is well defined. The body is very thick and round. The tail is dumpy, stoutly formed and abruptly terminates.

Scale formation.—The costal scales are imbricated, longer than broad and heavily keeled; they number 27, 29, 21, in the anterior, middle and posterior third of the body. The supralabials number 12. There is an absence of head shields. The sublinguals are in one pair. The ventral plates stretch across the belly and number 56 and 60. In the larger specimen the three terminal subcaudals

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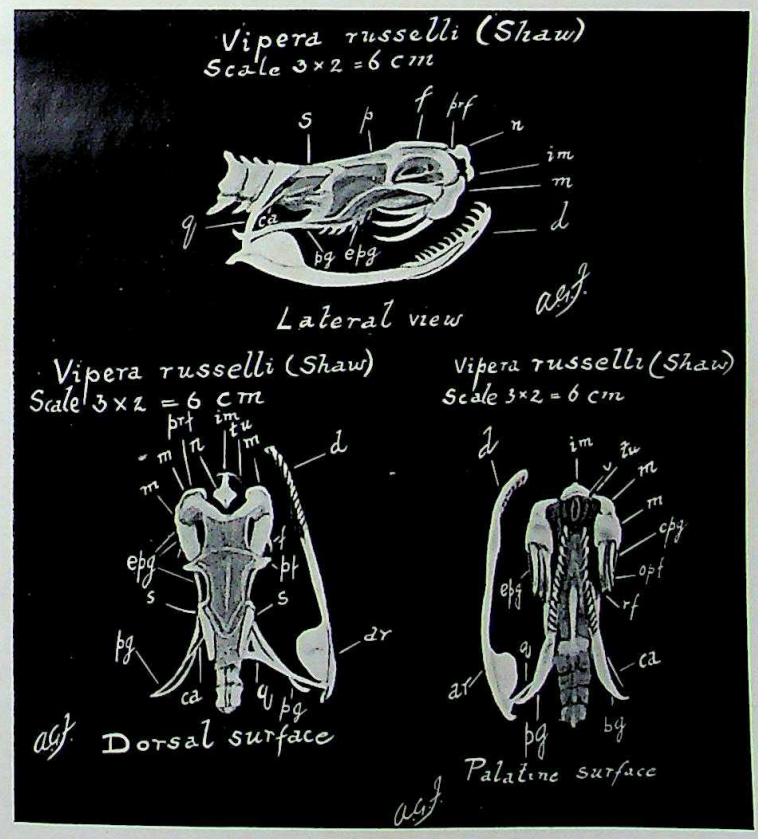

The Russell's Viper (*Vipera russelli*).

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were entire. The anal shield is entire. There is no uveal pit between the eye and the muzzle.

Colour.—The background is earthy brown with three series of black patches. The dorsal row, running centrally along the back, and large and leaf-shaped and confluent, those laterally situated are smaller and ovate and lie below and between the dorsal patches, and in places run on to the belly. All of these blotches are edged with white. There are black linear markings over the eyes and the snout. The rostral shield, the supralabials and the infralabials are orange-tinted and speckled with black. The belly is white.

Eye.—This is large. The pupil is vertical and the iris golden.

The nares are placed slightly superiorly and laterally in a forward position.

Length.—There were two specimens only. The larger measured 4 ft. 6 in. and the smalled 3 ft. 8 in.

Endoskeleton.—Anteriorly the skull shows a heavy bone formation. Posteriorly it is dorsally narrow and deep dorso-ventrally. The intermaxillary is small and placed in a forward position away from and above the maxillary. The nasals are small and shaped like the ace of diamonds. The division between them and the praefrontals is pronounced and linked over by cartilaginous connections. The turbinals are heavily formed. The praefrontals are thick, strongly built bones, dorsally and anteriorly convexed and fused together in front of the frontals from which they are divided by a suture. The frontals are short and broad. The parietals are small and anteriorly convexed, centrally ridged and posteriorly conically projected. The temporals are concavely depressed. The mastoid portion of the skull is prominently ridged and faceted for the articulation of the squamosals, which are thin, moderately long and flat. The quadrate is very long, posteriorly convexed, superiorly spatulate and laterally notched. Inferiorly it is rod-like and curved, showing a convexity posteriorly. The maxillary bones are massively formed and vertically fixed; in the relaxed state they are inclined backwards with the fangs bent in against the ectopterygoid. Superiorly, the articular surface for the reception of the praefrontal is concavely faceted. The rotary motion of the maxilla upon the convexed inferior border of the praefrontal projects the fang forward to an extreme degree. Anteriorly the maxilla shows a double convexity divided medially by a transverse constriction. Inferiorly it is broadly formed and shows the alveolar bony sockets for the reception of the fangs which are ankylosed to it. The ectopterygoid is thin, long and flat and arched backwards; the anterior section of it is broadly spatulate and wing-like, the posterior part narrows down and is angular at the point where it is laid upon the pterygoid in articulation. The pterygoid is moderately broad, ventrally grooved and does not touch the mandible. From the surface of the basi-sphenoid projected downwards and backwards is a process similar in shape to the hypapophyses of the vertebrae. To this process is attached the longus colli muscle. The mandibles are long and uniformly thick. The articular end is broadly formed, superiorly winged and slightly notched. The dentary portion is moderately sized.

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Dentition.—To the maxillary bones, in the one specimen examined, are ankylosed three canaliculated recurved fangs. One is operative and the other two are held in reserve. In the living specimens the two reserve fangs are encased in a mucous capsule. All of these fangs show formidable proportions and are much larger than any of the fangs noted in the proteroglypha. There are five solid recurved teeth set in the palatine bones. The pterygoids show seven teeth equal in size and length to those of the palatine. The dentary has 12 solid teeth, those anteriorly set are larger, and the teeth diminish in size from before backwards.

Vertebrae.—The cervical series are well defined by their finger-like neural spines. The thoracic vertebrae are differentiated by their squared neural spines being long dorso-ventrally in contrast with the dorsal vertebrae in which the neural spines are short squared extensions. The hypapophyses are well developed and of nearly uniform length throughout the first three vertebral divisions. The pseudo rib processes fused with the bodies of the cloacal and caudal vertebrae are long, slender, rounded rods as compared with the Colubridae in which they are short, slightly flattened blades.

Ribs.—These are strongly fashioned. The terminal ends are pointed. They are shorter anteriorly and increase in length. The longest and thickest dimensions are attained in the anterior and mid-dorsal series. From thence backwards there is a gradual decrease in length and thickness.

Locomotion.—The spiral curves are deep and the movement is slow and unwieldy. The writer killed one when in active motion on the Dharampur-Sabathu road (Simla Hills) in 1929. It was easy to keep up close behind the snake at not more than a walking pace.

Glandular structures.—There is a large densely lobulated gland on either side below and behind the eye. The venom is highly complex and the lethal quality of it is well known.

Habitat.—Ceylon, Peninsular India excluding the Ganges valley, Burma and Siam.

Note:—This is uncommon in Deolali. It is a hissing snake and will bite on the least provocation. Both the specimens secured were killed in the precincts of Barnes High School, Deolali. The single specimen examined by dissection proved to be a female. The other is preserved in the collection belonging to Mr. Fenton-Bailie of Barnes School. Mr. Flynn (1932)[1] records that a male and female secured by him on 25th April, 1929 were kept in a specially constructed box. On 12th July of the same year, 79 days after, he found the glass case swarming with young snakes. He collected thirty-three in all, twenty-seven were fully developed and six immature and dead and adherent to portions of the egg envelope. He remarks that the markings on the young were distinct and differed from the parent snake, being slaty grey above and light cream below.

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[1] 'The Family of a Russell's Viper' by A. A. L. Flynn, V.D., C.M.Z.S., *Journ. Bom. Nat. Hist. Soc.*, vol. xxxvi, No. 1, p. 271.

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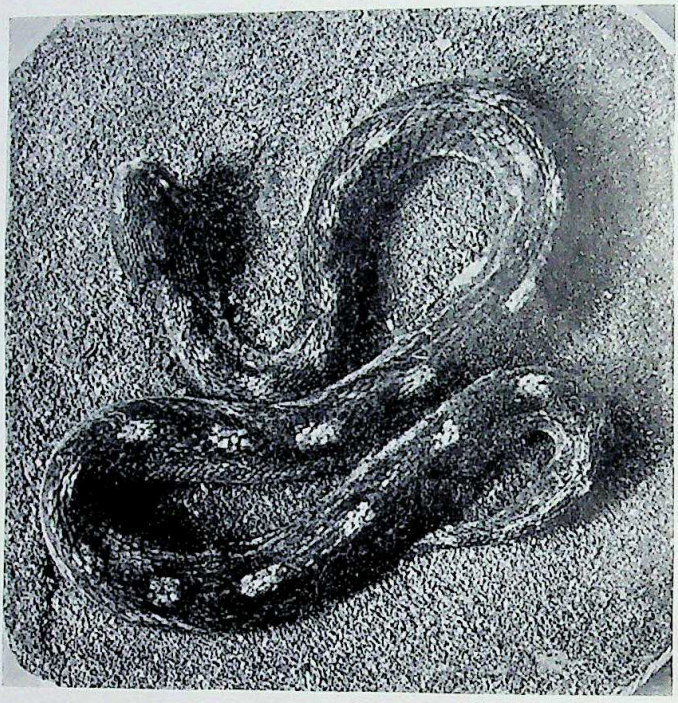

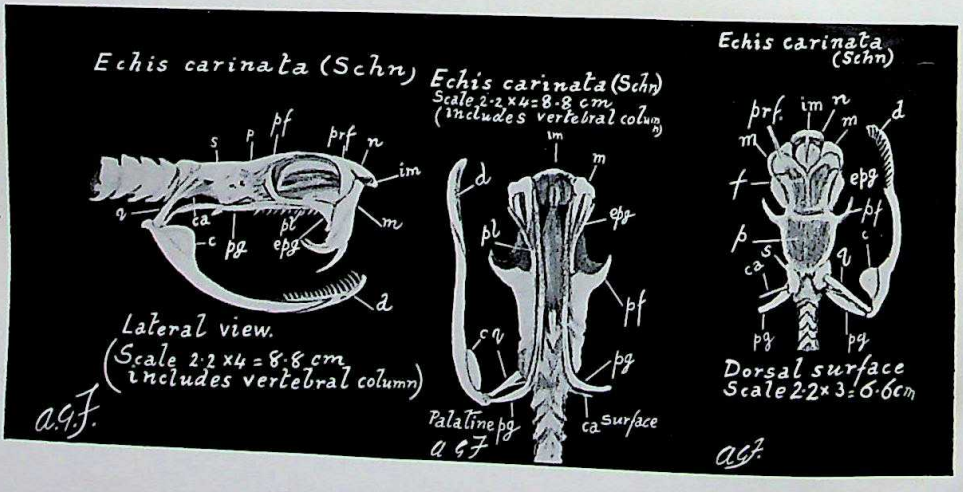

The Saw-scaled Viper (*Echis carinata*).

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Species : **Echis carinata** (Schn.) The Saw-scaled Viper.

Local name.—Phoorsa.

Exoskeleton.—The snout is obtuse. The head is small rounded and with a muscular prominence around the jaws. The body is stoutly built for so small a snake. The tail is short, thickly formed and abruptly terminated.

Scale formation.—The scales are imbricated, longer than broad, and heavily keeled. The supralabials number 9. There is only one pair of sublinguals. There are no head shields, and the uveal pit is absent. The postral is well defined. The costal scales vary in number from 23-27, 24-27, 21-23, in the anterior, middle and posterior third of the body. The ventral plates stretch across the belly and number from 145 to 155. The anal shield is entire. The subcaudals are entire. In two examples the first subcaudal below the anal shield showed a division.

Colour.—The background is earthy brown and in young specimens slaty. On the head there is the imprint of an arrow head. Dorsally on the back there are a series of white ovate spots edged with black. These white blotches are connected by white irregular striations running dorsally and laterally and enclosing patches of a darker shade. At first sight the colour and part design presentation are very like those of *Dipsadomorphus trigonatus*.

The eye is large and bulging. The pupils are vertical. The nares are placed slightly superiorly in a forward position.

Length.—The shortest measured 6¼ in. and the longest 19½ in. They are said to grow up to 2 feet.

Endoskeleton.—Anteriorly the skull shows a heavy bone formation. Posteriorly it is very narrow. The orbits are large for the small size of the skull. The intermaxillary bone is projected forward and separated from the maxillary bones. The nasals are small. The maxillaries are broad, thick, heavily formed and set obliquely. Superiorly the maxillary bone shows a process which abuts against the praefrontal and is chiefly involved in the articulation with it. The process itself posteriorly is concave and adapted to rotate on the praefrontal convexity. The anterior and lateral surfaces of the maxillary are slightly convex and slope downwards and slightly backwards. Like in the Russell's Viper this bone in the relaxed state is inclined backwards; the inferior surface is convexed and its posterior border shows an alveolar ridge to which are ankylosed the fangs. The maxillary bones are specifically large and well developed for so small a snake. The praefrontals are also large and heavily formed, they are fused together in front of and in the adults with the frontal bones. In the younger snakes a suture divides them from the frontals. The frontal bones are dorsally convexed, medium sized and in the adult, centrally ridged by ossification, but in the young they are divided by a suture. The parietals are also in the adult dorsally slightly convexed and centrally ridged and in young specimens suturally divided. The post-frontal zygomatic process juts out laterally. The temporals are depressed by a sulcus for the muscle and lodgement of the poison gland. The squamosals are short, broad and flat. The quadrates are long rods of bone slightly spatulate inferiorly. The

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ectopterygoids are anteriorly broadly winged and convexed and adapted to fit the concave articular surfaces of the maxillaries; posteriorly they terminate in a point laid over the pterygoids. The pterygoid bones are vertically set narrow plates, and posteriorly are slightly grooved on the ventral aspects and touch the mandibles. As in the case of the Russell's Viper, a process is projected from the basi-sphenoid, downwards and backwards and resembles in formation the hypapophyses of the vertebrae. The mandibles are ventrally convexed and rounded; superiorly the ramus portion is winged and notched. The dentary portion is short and lightly formed.

Dentition.—The number, setting and arrangement of the proteroglyphous fangs and the solid teeth are identical with those of the Russell's Viper, except that in this snake the dentary is set with sixteen instead of twelve solid teeth.

Vertebrae.—As described for the Russell's Viper, only proportionately smaller.

Ribs.—As described for the Russell's Viper.

Locomotion.—The same as for the Russell's Viper.

Gland structure.—Conforms with that of the Russell's Viper and is proportionately smaller. Lethal doses of the venom produce fatalities in man and in some cases there is a delayed action.

Habitat.—Ceylon, Peninsular India, Baluchistan, Afghanistan, Transcaspia, Persia, Arabia and Africa—north of the Equator.

Note :—Altogether 6 specimens were encountered. Five of these belonged to Mr. Fenton-Bailie's collection. It is an uncommon species in Deolali.

SPECIES EXTRANEOUS TO DEOLALI

FAMILY : COLUBRIDÆ.

SUB-FAMILY : DIPSADINÆ *'Opisthoglypha'*.

Species : **Dipsadomorphus beddomei** (Fitz.)

This specimen reached Deolali in a sewn sack of potatoes. The particular sack was issued to the British Troops Ration centre at Munroe lines, Deolali on the 11th September, 1934. When the sack was opened and the potatoes were rolled out on the floor the live snake was discovered and killed. It was identified as noted above. Further inquiry from the Officer in charge of Supplies elicited the information that a consignment of potatoes had been received by the Contractor from Mahableshwar (Deccan) and the sack in question belonged to that consignment.

Exoskeleton.—The formation is slender for the length of the specimen. The snout is obtuse. The head is oval and the neck distinct. The cervical section is slender. The body in the middle third is thicker, laterally compressed and dorsally ridged and posteriorly it thins out. The tail is rounded, very long and tapering.

Scale formation.—The scales are imbricated and longer than broad. The dorsal scales which are centrally placed in the long axis of the body are enlarged and equal in size to those of the

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Krait. These scales are particularly large in the posterior third of the body. The costal rows of scales numbered 19, 19, 13, in the anterior, middle and posterior third of the body respectively. The supralabials numbered 8; the first and second touched the nasals; the third, fourth and fifth touched the eye; and the sixth and seventh the temporal shields. There was one loreal. The praeoculars and postoculars numbered 2 each. There were two pairs of sublinguals. The infralabials numbered 10. The anal shield was entire. The subcaudals numbered 112 and were divided throughout. The ventrals numbered 246 and stretched completely across the belly.

Colour.—The background was a brownish khaki. The head was brown and deeply tinged with yellow between each shield and scale division. The supralabials, infralabials and the under-surface of the neck were stained a deep yellow. The nape of the neck was irregularly spotted with black. The anterior half of the body was a brownish khaki. The belly in this section was yellow. The posterior half of the body was a light yellowish brown and the belly in this portion was white. There were irregular faint striations in black along the back. About the middle third these striations were more chevron-like in formation. The costal margins were spotted black in two parallel series decreasing towards the tail.

Length.—36 in. Sex :—female.

Eye.—This was fairly large and bulging. The pupil vertical. The nares were laterally placed in a forward position near the rostral.

Endoskeleton.—The formation, size and shape of the skull is on the lines already described for *D. trigonatus* with the following exceptions :—

The parietals end posteriorly in a point slightly overlapped by the supraoccipital crest. The ectopterygoids are slightly broader and jut out laterally on either side of the skull. The maxillary is inclined downwards and not as horizontally positioned as in *D. trigonatus* and the posterior section of it is not as long as in the Deolali species. The articular ramus of the mandible is superiorly definitely winged and notched.

Dentition.—The maxillary is anteriorly set with 12 solid teeth of nearly equal size and length and two anteriorly grooved and recurved fangs posteriorly, as the last in the maxillary series of teeth. The palatines are set with 5 and the pterygoids with 8 solid teeth, all of these are equal in size and length. The dentary has 14 solid teeth; the anterior series are long and recurved and the teeth diminish in size from before backwards.

Vertebrae.—The formation is the same as in *D. trigonatus.*

Ribs.—As in *D. trigonatus.*

Locomotion.—This was not observed.

Habitat.—Western Ghats (Matheran to Travancore) and the Ceylon Hills.

Note :—A lizard of the Gecko type (like the common wall lizard, but darker coloured) was found in the alimentary canal of this specimen.

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SUB-FAMILY : COLUBRINÆ *Aglypha*

Species : **Polyodontophis collaris** (Blgr.).

This specimen was received from Barrackpore (Bengal). A description of it has been included in this paper for purposes of comparison in view of the species *Polyodontophis subpunctatus* which belongs to Deolali not having been dealt with on the points of osteology and dentition owing to the bad mutilation of the skull and vertebral column of the only specimen collected.

Exoskeleton.—The formation is of a uniform thickness. The head and body are uniform and show no neck delineation. The snout is obtuse. The body is of uniform thickness decreasing towards the vent. The tail is moderately tapering.

Scale formation.—The scales are retiform and rounded. There is no evidence of keeling. The supralabials number 10; the first and second touch the nasal; the fourth, fifth and sixth touch the eye; and the eighth and ninth the temporal shields. There is one loreal. The sublinguals are in two pairs. The praeoculars and postoculars number two each. The costal scales number 17, 17, 17, rows in the anterior, middle and posterior third of the body respectively. The anal shield is divided into two sections. The subcaudals numbered 109 and were divided throughout. The ventrals numbered 176 and stretched completely across the belly.

This specimen had been bottled in spirit for some time. The colour now described would not be quite an accurate version of the original living specimen. The head showed a sepia tone. There were narrow black striations of a chevron form anteriorly on the head. The nape of the neck showed a broad black collar and posterior to this a frill in white. The anterior two-thirds of the body showed in the cervical region a dark stained area merging behind into a salmon pink. The posterior third of the body was a blackish brown. The belly was white. Along the costal margin there was one dotted line in black on each ventral, which spots ended at the vent. Length :—2 feet 1¼ inches.

The eye was moderately large. The pupil spherical. The nares were placed laterally.

Endoskeleton.—The shape of the skull is oval in the anterior two-thirds of its length. The posterior portion is squared. The intermaxillary is small and placed between the maxillary bones. The nasals are small and shaped like the club of a pack of cards. The frontals are small and show no sutural division. The praefrontals are broadly formed and angled at its corners. The parietals are rounded dorsally and broad, showing no sutural divisions; they are divided from the frontals by a suture. The posterior part of the parietals is rounded off and suturally divided from the occipital segment. The maxillary bones are laterally convexed and in their length slightly inclined downwards and then horizontally backwards; they are thin, long and extend backwards beyond its ectopterygoid articulation. The ectopterygoid is short, thick and arched. The maxillary articular end is broadly and thickly spatulate, posteriorly it thins out; the inner border is convex and laterally on its outer aspect it is concave. The palatines

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are slender vertical plates. The pterygoid is narrow throughout, but posteriorly slightly broader than the anterior part. It is not grooved ventrally but it touches the mandible. The quadrate is long, superiorly spatulate and shaped like an inverted foot, and inferiorly rod-like and bulbous at the articular termination fitting into the notch of the ramus of the mandible. The squamosals are short, nearly straight and flat plates. The mandible is convex ventrally. The articular ramus is broadly formed and notched; laterally on the outer sides there is a depression and anteriorly justly below the superiorly notched extension is a foramen. The dentary portion shows a specific divergence featured by this section being turned inward at an angle of 120 degrees. In this respect it is quite unlike any other species in Deolali.

Dentition.—There are no grooved or perforated fangs. All the teeth are solid and show a specific character by being peg-topped instead of pointed as in the other species of this family. This species has numerous teeth. The maxillary series number 46 of nearly uniform size and length, those anteriorly set slightly smaller. The palatine and pterygoid teeth show no marked division separating them from each other. Altogether they number 54; the palatine number 12. The dentary has 18 teeth, of which the posterior ones are the larger.

Vertebrae.—The neural spines are short and long in correspondence with the specific formation of the vertebrae which are long antero-posteriorly and short dorso-ventrally. In this respect they differ from the vertebrae of other species in which the diameters are nearly uniform in length. The hypapophyses are well developed in the cervical region and projected backwards more acutely. They diminish gradually in length until in the last vertebra it is reduced to a slight eminence. In the dorsal section there is a complete absence of this process. Except for these differences the vertebrae in this snake conform in formation to the vertebrae of other species.

Locomotion.—This has not been observed.

Gland structure.—A soft white parotid gland. The secretion, as shown by Mme Phisalix and Caius, is toxic to small birds without, however, killing them.

Habitat.—Himalayas, Bengal, Assam, and Burma.

Acknowledgments.

Apart from the study of the osteological peculiarities made directly from prepared endoskeletons, radiography was utilised as an additional aid. I am therefore very much indebted and grateful to Major J. A. Crawford, R.A.M.C., who was during the period the Senior Medical Officer in this station, for his kindness in not only allowing the use of the X-Ray apparatus of that department attached to the British Military Hospital, but also for editing the manuscript copy of this paper and for the encouragement given. My thanks are due to Messrs. C. P. Coshan and D. J. Nayler, I.M.D. for the skilled aid accorded in securing the radiographs. I have also to thank the following gentlemen for

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Explanation of Lettering on Plates.

ana,—Anterior neural arch. aps,—Anapophysis. ac,—Acetabulum centrum. ar,—Articular ramus, ar,R,—Articular surface for rib. bo,—Basi-occipital. bs,—Basi-sphenoid. cr,—Cervical-rib. cor,—Coronoid. c,—Centrum. cv,—Cervical vertebra. ca,—Columella auris. d,—Dentary. eo,—Exoccipital. epg,—Ecto-pterygoid (or transpalatine). ec,—Epiphysis centrum. f,—Frontal. fm.—Foramen magnum. fo,—Fenestra ovalis. fr,—Fenestra rotunda. fvn,—Foramen for 5th nerve. hs,—Hypapophysis. hp,—Hæmal process. im,—Intermaxillary (praemaxilla). irp,—Inferior rib process. lf,—Lachrymal foramen. me,—Mandible. m,—Maxillary. md,—Mastoid. mp,—Metapophysis. ns,—Neural spine. no,a,—Neural arch alae. of,—Optic foramen. oa,—Orbital aperture. odp,—Odontoid process. od,—Odontoid. og,—Orbital groove. pl,—Palatine. pg,—Pterygoid. prf,—Praefrontal. pf.—Post-frontal. pc,—Periotic. przs,—Praezygapophysis. ptzs,—Postzygapophysis. pna,—Posterior neural arch. p.—Parietal. q,—Quadrate (tympanic). rfg,—Reserve fang. s,—Squamosal. sg, or gs,—Gland sulcus. sp.—Sphenoid. so,—Supra-occipital. srp,—Superior rib process. tu,—Turibnal. tp,—Transverse process. t,—Temporal. v,—Vomer.

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FISH OF DEOLALI.

BY

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PART I.

(*With two plates*).

INTRODUCTION AND LIST OF MATERIAL.

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In 1935, the Zoological Survey of India received a small collection of fish from Deolali made by Dr. A. G. L. Fraser at the request of Mr. S. H. Prater. This material comprised seven species, of which two proved to be new to science.[1] As the headwaters of the Godaveri were so far a *terra incognita* for ichthyologists, a request was made to Dr. Fraser through Mr. Prater to make a comprehensive collection of fish at Deolali and its environs. The result has been most satisfactory. Dr. Fraser collected fishes for one year—June 1935 to May 1936—and obtained 4,463 specimens from several localities. The material is in an excellent state of preservation while the ecological factors governing fish life in various types of habitats are vividly described by Dr. Fraser in the descriptions of the localities where the collections were made.

To suit the convenience of the editors of the *Journal*, it is proposed to publish the account of the fish of Deolali in four parts. The first part, as is indicated in the title above, deals with the descriptions of the localities and the material obtained from each locality is listed separately. The second part will contain descriptions of two new species belonging to the genera *Parapsilorhynchus* and *Barbus* and notes on other species. In the third part Dr. A. G. L. Fraser will, in a series of notes, record his observations, both under natural and artificial conditions, on the biology and ecology of the fishes collected by him. In the final part one of us will discuss the geographical relationships of the fish fauna of Deolali, with special reference to its affinities with that of the Deccan.

A complete set of the material, containing type-specimens, is deposited in the collection of the Zoological Survey of India, while a representative series of examples is also preserved in the collections of the Bombay Natural History Society and of the British Museum of Natural History in London.

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[1] Hora, S. L. and Mukerji, D. D.—*Notes on Fishes in the Indian Museum*, xxv. On two new species of Cyprinid Fishes from Deolali, Nasik District, Bombay Presidency. *Rec. Ind. Mus.*, xxxvii, pp. 375-80 (1935).

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We take this opportunity to offer our sincerest thanks to Dr. Fraser for the great trouble he must have taken in the collection and preservation of this enormous material, and for his lucid notes regarding the habitats of the various species. We have also to record our indebtedness to Mr. S. H. Prater for his kind interest in the matter and for affording us an opportunity to investigate this interesting material. The Bombay Natural History Society very kindly agreed to our retaining a complete set of the material for the collection of the Zoological Survey of India and further made a grant towards illustrations and other incidental expenses; for all this we are very thankful to the authorities of the Society.

Geographical Location and Physical Features of Deolali.

Dr. Fraser[1] in his account of the snakes of Deolali gives a description of the geographical location, meteorology and physical features of the station but to facilitate reference some of the salient features are reiterated here. Devláli or Deolali is a small military cantonment in the Nasik District of the Bombay Presidency. Deolali is about 4 miles south-east of Nasik and the military cantonment 'is situated about three and a half miles to the south-west, on land formerly included in the villages of Bhagur and Sewnsuri and unconnected with Devláli.'[2]

List Material with Descriptions of Localities.

1. North Nallah pool, 3 miles west of its junction with the Darna river (Dairy Pool). Deolali, 27-6-1935.

The pool is an artificially created one, being formed by a masonry dam and built up stone embankments. It is 40 feet wide and 50 feet long with a depth of from 2 to 5 feet. Its bed is well sanded and its sides in the shallow parts are flagged with stone. It is used for washing cattle belonging to the Military Dairy farm and buffaloes are left to wallow in it for long hours, especially during the hot months of April and May. The pool itself is free from vegetation and its banks are sparsely grown with grass. At this time of the year, owing to the rains, the water in it is muddy and

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[1] Fraser, A. G. L. 'The Snakes of Deolali'. *Journ. Bom. Nat. Hist. Soc.*, xxxix, pp. 59, 60 (1936).

[2] Cambell, J. M.—*Gazetteer of the Bombay Presidency*, xvi, Nasik, p. 431 (Bombay : 1883).

The height above the mean sea level is from 1,800 to 2,300 ft. The average rainfall is 30 in. The monsoon months are June, July, August and part of September. The hottest months of the year are March, April and May, with the maximum shade temperature between 100 and 110° F. Dry and Wet bulb registrations show a marked humidity during October.

The topography of the country in the environs is undulating in character. On the south side lie the Thal Ghat extensions running east and west. The land is for most part under cultivation, and is intersected by deep tributary 'Nallahs' draining into the river 'Darna', which meanders through east of the Cantonment in a north-easterly direction to a point some 10 miles east of Nasik City, where at 'Darna Sangava' it joins the sacred river Godaveri. (Fraser, *loc. cit.*).

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the volume and flow of water over the dam is greater than during the dry weather when it dwindles to a trickle.

i. *Barilius bendelisis* Ham. ... ... 3 specimens.
ii. *Rasbora labiosa* Mukerji. ... ... 25 specimens.
iii. *Parapsilorhynchus* (New species) ... ... 1 specimen.
iv. *Nemachilus denisonii* Day. ... ... 2 specimens.
v. *Ophicephalus gachua* Ham. ... ... 1 specimen.

2. Section of North Nallah, 1,800 yards from its junction with the Darna river. Deolali, 30-6-1935.

The bed of the Nallah is shelving; and centrally there is a channel about 25 feet wide and from 2 to 3 feet in depth. The sloping banks are covered with varied flora, growing both in the water and on the banks. There is a fair volume of water flowing through this section of the nallah at all times of the year because of the proximity of the Deolali Bazaar, which lies a little to the west on its north bank and the waste water from the Bazaar runs into the nallah.

i. *Rasbora labiosa* Mukerji ... ... 14 specimens.

3. North Nallah, at a point 800 yards west of its junction with the Darna river. Deolali, 4-7-1935.

This part of the nallah is a narrow rocky defile. The banks are high and the sides precipitous, and the channel itself is difficult of access. There is no vegetation in it, but its high banks are grass grown. The depth of the water in this channel was barely 2 feet at the time the fish were taken, but this was just after abatement of the storm water, when the depth must have been at the least 3 feet. The current of the water flowing through it is strong. The sides of the defile, particularly the bases of the banks, are undermined. The rocky bed of the channel itself is eroded and shelved. It is 15 to 20 feet in width. There is also some silt in the bed.

i. *Chela clupeoides* (Bloch) ... ... 1 specimen.
ii. *Danio aequipinnatus* (McClell.) ... ... 3 specimens.
iii. *Barbus ticto* (Ham.) ... ... 3 specimens.
iv. *Garra mullya* (Sykes) ... ... 5 specimens.
v. *Labeo boggut* (Sykes) ... ... 2 specimens.

4. North Nallah, 50 yards west of its junction with the Darna river. Deolali, 14-7-1935.

Here the nallah broadens out and the banks are shelving and slope down to the river. The width of the stream is from 40 to 50 feet. Its depth is about 2 feet at the sides to over 6 feet in the centre. The bed is silted and the flow of water is fairly strong at all times of the year. There is an exuberant growth of vegetation both on the banks and in mid-stream which is full of weeds. Bhil fishermen tell me there are no big fish in this section as it is too open. The few fishes secured by me here are all significantly enough small fry.

i. *Chela clupeoides* (Bloch) ... ... 6 specimens.
ii. *Rasbora labiosa* Mukerji ... ... 1 specimen.
iii. *Barbus ticto* (Ham.) ... ... 1 specimen.
iv. *Parapsilorhynchus* (New species) ... ... 1 specimen.
v. *Ambassis nama* (Ham.) ... ... 3 specimens.
vi. *Ambassis ranga* (Ham.) ... ... 1 specimen.

5. The Waldi river, at a point 2 miles east of its junction with the Darna river up to the village of Chedi; 7-11-1935.

The Waldi river is a tributary of the Darna. The fishes were caught at a point near to the bridge on the Deolali-Nasik road. The village of Deolali is on the north bank, and a few hamlets on the south bank constitute

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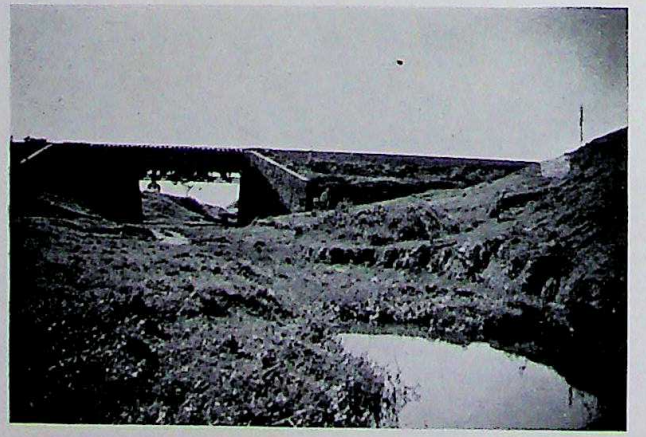
1. View of section of North Nallah in which *Barilius bendelesis* was found. Bhil name *Jhor*.

2. View of pool in course of North Nallah.



3. Pool between railway bridge in a section of the North Nallah stream.

4. Junction of the North Nallah with Darna River.

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a village called Edhgaon. At the time the spot was visited the river was swollen with muddy flood water, turbulently rushing through. It was impracticable to effectively use a net. A spot was selected where it was possible to cast a net from the bank and the fish were really taken from the surface currents. The river here is 50 yards wide and was easily 20 feet deep as a result of the storm waters. The bed in this section is rocky. Owing to the villages in the close proximity the vegetation is scanty and the higher earthy banks are grass-grown. In the dry weather there is less water, but the flow is strong at all times. The river has its origin in the hills at Anjem and Dhammia at an altitude of 4,295 feet above sea level. It is fed from springs at various points along its course and there is a fair volume of water running through at all times of the year. It is roughly 22 miles in extent not taking into account the meanderings. It joins the river Darna one mile west of the village Cheri and about 2 miles east of the village of Deolali.

i. *Barilius bendelisis* Ham. ... ... 46 specimens.
ii. *Danio fraseri* Hora ... ... 11 specimens.
iii. *Barbus khudree* Sykes ... ... 2 specimens.
iv. *Barbus ticto* (Ham.) ... ... 91 specimens.
v. *Nemachilus botius* (Ham.) ... ... 3 specimens.
vi. *Nemachilus denisonii* Day ... ... 1 specimen.
vii. *Ophicephalus gachua* Ham. ... ... 1 specimen.

6. The Darna river, at the ferry point near Bagoor village. Deolali; 25-7-1935.

The fish were caught at a time when the river was swollen with flood water. The banks are grass grown and there are a fair number of gum acacia (*babul*) trees in the near precincts. The width of the river here is 80 to 100 yards (approximate). The depth near the banks is from 2 to 3 feet. Midstream it must be 30 feet. The Darna river is a tributary of the Godaveri and joins it some 10 miles east of Nasik City at a village called Darna Sangava. It has its source in the hills around Igatpuri (Thall Ghats). It is fed from springs and the waters from Lake Beale, which is 3 miles from Aswali Railway Station (G.I.P.R.). This river flows in a north-easterly direction and is one and a half miles east of Deolali Cantonment.

i. *Notopterus notopterus* (Pallas) ... ... 7 specimens.
ii. *Chela clupeoides* (Bloch) ... ... 74 specimens.
iii. *Chela phulo* (Ham.) ... ... 13 specimens.
iv. *Barilius bendelisis* (Ham.) ... ... 21 specimens.
v. *Danio aequipinnatus* (McClelland) ... ... 1 specimen.
vi. *Rasbora labiosa* Mukerji ... ... 2 specimens.
vii. *Aspidoparia morar* (Ham.) ... ... 14 specimens.
viii. *Barbus khudree* Sykes ... ... 3 specimens.
ix. *Barbus kolus* Sykes ... ... 14 specimens.
x. *Barbus ticto* (Ham.) ... ... 28 specimens.
xi. *Barbus* (new species) ... ... 1 specimen.
xii. *Labeo boggut* (Sykes) ... ... 2 specimens.
xiii. *Rohtee cotio* (Ham.) ... ... 6 specimens.
xiv. *Lepidocephalichthys guntea* (Ham.) ... ... 1 specimen.
xv. *Nemachilus botius* (Ham.) ... ... 2 specimens.
xvi. *Nemachilus denisonii* Day ... ... 1 specimen.
xvii. *Proeutropiichthys taakree* (Sykes) ... ... 18 specimens.
xviii. *Ambassis baculis* (Ham.) ... ... 2 specimens.
xix. *Ambassis nama* (Ham.) ... ... 1 specimen.
xx. *Ambassis ranga* (Ham.) ... ... 36 specimens.

7. Swimming pool of Barnes High School, Deolali in the course of Narsullah Wadi, a tributary of the Darna river. Deolali, 28-7-1935.

This channel has the features of the 'North Nallah'. It is fed by springs and during the rains rushes with storm water. In the dry weather the

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volume and flow are poor. The flora on its banks and in the stream itself is identical with that found in the North Nallah. The channel runs on the southern boundary of Deolali Cantonment and is roughly 2 miles south of it.'

i.	*Barilius bendelisis* Ham.	41 specimens.
ii.	*Danio fraseri* Hora	11 specimens.
iii.	*Rasbora daniconius* (Ham.)	27 specimens.
iv.	*Barbus ticto* (Ham.)	19 specimens.

8. The Darna river, at a point midway between the villages of Sewnsuri and Beladgaon; 8-8-1935.

The river flows nearly due north from Sewnsuri onward past Beladgaon. At the halfway point there is a stretch of about two furlongs extent where the bed widens out and here the river is approximately 80 yards broad. About 35 yards of this width at the side of the west bank is a pebbled beach. The river itself in this section flows in three separate streams of some 10 15 and 20 yards width respectively. In between are some islands which are grown with sedge and tall rushes. These islands appear to be shingle in the form of dried silt and are alluvial in character. The main volume and force of the water are exerted directly on the east bank, where the depth at this season is easily 12 feet or more and in the dry season would be from 8 to 10 feet. The two lesser streams are ankle deep at the sides and knee deep in the middle. The beds of the stream are pebbled and sanded, and in parts rocky. The force and volume of water are good at all times of the year; but the river is more swollen and muddy now due to the rains. The relative height of the banks to the bed is 25 feet. Cultivated fields adjoin the banks. The height above sea level is 1,800 feet.

i.	*Chela clupeoides* (Bloch)	41 specimens.
ii.	*Barilius bendelisis* Ham.	40 specimens.
iii.	*Rasbora daniconius* (Ham.)	1 specimen.
iv.	*Aspidoparia morar* (Ham.)	3 specimens.
v.	*Barbus chola* (Ham.)	3 specimens.
vi.	*Barbus khudree* Sykes	2 specimens.
vii.	*Barbus kolus* Sykes	3 specimens.
viii.	*Barbus ticto* (Ham.)	9 specimens.
ix.	*Barbus* (new species)	2 specimens.
x.	*Rohtee cotio* (Ham.)	1 specimen.
xi.	*Lepidocephalichthys guntea* (Ham.)	1 specimen.
xii.	*Nemachilus botius* (Ham.)	2 specimens
xiii.	*Callichrous bimaculatus* (Bloch)	1 specimen.
xiv.	*Proeutropiichthys taakree* (Sykes)	2 specimens.
xv.	*Ophicephalus marulius* Ham.	1 specimen.

9. The Waldi river, near the village of Pimpalgaon Khamb; 17-8-1935.

The Waldi river flows from west to east. The heights of the banks in relation to the bed of the river are approximately fifty feet. The depth in the section explored is roughly from one foot on the south bank to 8 feet midstream and 12 feet at the river's edge directly against the north bank, where the main volume and force of the water are exerted. The width here is 50 to 60 feet. The volume and flow of water are full and strong at all times of the year, but at the time of the visit the river was moderately swollen with muddy storm waters. The bed is also rocky and sanded and silted in parts. In this particular section it is free from vegetation. The opposite bank is precipitous and for a little more than half its height consists of basalt rock. The rounded and irregular earthy strata on the top fifty feet above are covered with grass and heavily wooded with 'babul' and 'mango' trees. The height above sea level is 1,900 feet.

i.	*Barilius bendelisis* Ham.	2 specimens.
ii.	*Danio aequipinnatus* (McClell.)	1 specimen.
iii.	*Rasbora daniconius* (Ham.)	1 specimen.
iv.	*Barbus khudree* Sykes	45 specimens.

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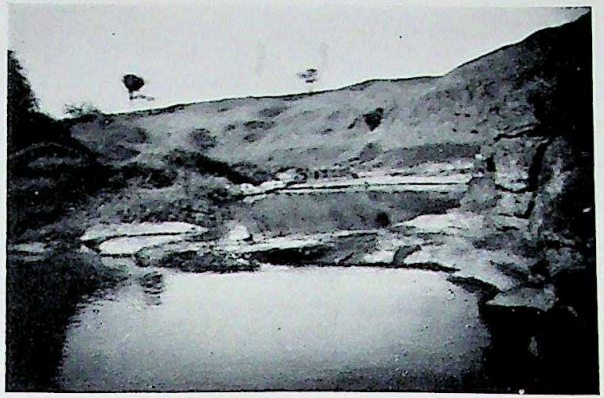
1. View of section of the Narsullah wadi running through Barnes High School.



2. Rocky section of lower stretch of Narsullah wadi near village of Bagoor.

3. Darna River near Goti Railway Station (G. I. P.).

4. Stretch of Darna River halfway between villages of Swensuri and Beladgaon.

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v.	*Barbus kolus* Sykes	1 specimen.
vi.	*Barbus ticto* (Ham.)	67 specimens.
vii.	*Garra mullya* (Sykes)	1 specimen.
viii.	*Nemachilus botius* (Ham.)	3 specimens.
ix.	*Ophicephalus gachua* Ham.	2 specimens.

10. Lower section of Narsullah Wadi, near the village of Bagoor; 25-8-1935.

Here the stream broadens out and flows over a rocky bed before reaching a broad cutting between earthy banks. The width of the channel in this section is some 30 yards. The north bank maintains a relative height of 30 feet above the water line of the stream, even at its junction with the Darna and continues in an easterly direction as the north bank of the Darna, which in this locality flows due east. The south bank of the Narsullah Wadi slopes down from a height of 20 feet and ends flush with the north-west bank of the Darna as the latter at the point of junction has a bend in the course, deflecting it to the east. The depth of the section explored is from 2 feet at the sides to 8 feet midstream. The bed of the stream here is silted up. The upper and higher reach is rocky. The banks are grass-grown and the edges of the stream are fringed with rushes and some weeds. The volume of water is full and strong at all times of the year. At this season the stream is moderately swollen with muddy flood water.

i.	*Barilius bendelisis* Ham.	17 specimens.
ii.	*Danio aequipinnatus* (McClell.)	11 specimens.
iii.	*Rasbora daniconius* (Ham.)	1 specimen.
iv.	*Rasbora labiosa* Mukerji	31 specimens.
v.	*Barbus ticto* (Ham.)	222 specimens.
vi.	*Garra mullya* (Sykes)	12 specimens.
vii.	*Parapsilorhynchus* (New species)	7 specimens.
viii.	*Lepidocephalichthys guntea* (Ham.)	1 specimen.
ix.	*Nemachilus denisonii* Day	1 specimen.
x.	*Ophicephalus gachua* Ham.	5 specimens.

11. Pool of a tributary 'Nallah' of the Darna river, near the 110th mile of the railway track on the Deolali to Igatpuri line; 29-8-1935.

The actual site of the pool in this 'Nallah' is some 200 yards from the railway bridge. This pool has been naturally formed by the stream running into a natural depression in the ground. Practically the whole of this is rock and the outfall has been bunded up by a natural dam of rock over which the water falls and continues its course in an easterly direction to join the Darna. The relative height of the banks which are rock overlaid by an earthy stratum is about 25 feet. The bed of the pool is silted up over its rocky base. The width of the pool is 20 feet and its length is roughly 70 feet. The depth of water is from 2 to 3½ feet. The earthy stratum is grown with grasses and the highland in the vicinity is given over to cultivation. The height above the sea level near this point is 1,852 feet. The total extent of this tributary nallah is roughly 2½ miles. It takes its origin from springs which are located about half a mile or more due west of the railway bridge and flows all the year though the volume is very poor during the dry months. At this season it is flowing strongly with muddy storm water drainage.

i.	*Barilius bendelisis* Ham.	3 specimens.
ii.	*Rasbora daniconius* (Ham.)	1 specimen.

12. The Darna river, near to the village of Sewnsuri; 8-9-1935.

The part explored was from the west bank against the village of 'Sewnsuri'. The greater part of this bank is rocky and shelving. The village is super-imposed and built upon the part rocky base and part earthy layer which uprises from the shelving riverside, and is roughly 40 feet above the river.

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A road from the village leads down to the river and opens directly on to the very wide and shelving rocky plinth. The village population is about 1,000. The inhabitants use the river for all purposes. Their cattle are also bathed in the river. A local industry of preparing raw hides is carried on in this village. The fresh skins are scraped and cleaned at the river side and then dried. The scrapings from the hides pollute the river and the portion of the bank where the work is done is therefore very insanitary. The shelving plinth is free from vegetation and is roughly 80 yards long and 30 yards or more broad. In the south corner of the plinth is a small temple with a shrine, the base of which is just over the water line. The villagers throw food stuff into the river and feed the fish. They do not object to fishes being caught; they invite you even on the temple site and in a friendly spirit show you the likely spots where big fish are to be had. The width of the river is about 40 feet and the depth is from 3 to 4 feet on the west bank, from 4 to 5 feet midstream and one foot on the east bank where there is a sanded beach. The opposite bank is from 10 to 15 feet high and is grown with grasses and bordered with fields under cultivation. The bed of the river on the side of the west bank is practically all rock. Midstream it is sanded and silted. The volume of water is good at all times of the year. Now the river is moderately swollen and muddy with storm water. The height above the sea level is approximatey 1,820 feet.

i.	*Chela clupeoides* (Bloch)	1 specimen.
ii.	*Barilius bendelisis* Ham.	6 specimens.
iii.	*Rasbora daniconius* (Ham.)	1 specimen.
iv.	*Barbus chola* (Ham.)	1 specimen.
v.	*Barbus kolus* Skyes	1 specimen.
vi.	*Barbus ticto* (Ham.)	123 specimens.
vii.	*Barbus* (new species)	4 specimens.
viii.	*Lepidocephalichthys guntea* (Ham.)	10 specimens.
ix.	*Nemachilus botius* (Ham.)	11 specimens.
x.	*Nemachilus denisonii* Day	13 specimens.
xi.	*Heteropneustes fossilis* (Bloch)	2 specimens.
xii.	*Mystus cavasius* (Ham.)	1 specimen.
xiii.	*Ophicephalus gachua* Ham.	6 specimens.
xiv.	*Ophicephalus marulius* Ham.	2 specimens.
xv.	*Ambassis ranga* (Ham.)	1 specimen.
xvi.	*Glossogobius giuris* (Ham.)	1 specimen.

13. Middle section of the Narsullah Wadi meandering through the Barnes High School Estate; 12-9-1935.

For the description of the locality see No. 10.

i.	*Barilius bendelisis* Ham.	9 specimens.
ii.	*Danio aequipinnatus* (McClell.)	23 specimens.
iii.	*Rasbora labiosa* Mukerji	112 specimens.
iv.	*Garra mullya* (Sykes)	13 specimens.
v.	*Parapsilorhynchus* (new species)	18 specimens.
vi.	*Lepidocephalichthys guntea* (Ham.)	32 specimens.
vii.	*Nemachilus denisonii* Day	60 specimens.
viii.	*Nemachilus evezardi* Day	4 specimens.

14. Pool at the source of the Narsullah Wadi; 12-9-1935.

The upper section of the 'Narsullah Wadi' courses down through narrow shallow channels from 4 to 5 feet wide and is barely ankle deep except in the two or three pools in its whole extent where the water is knee deep. It is fed from a series of three springs which issue and originate at the bases of two tors, the chief one of which is named 'Siva Donghai', 2,527 feet above the sea level. This region is a stony waste except in certain parts which are sparsely grown with grass. For roughly a mile in this section the bed of the stream is rocky and sanded. Thereafter the terrain becomes earthy black soil and the banks are bordered with fields under cultivation. At this season 'bajri' and 'groundnut' are in evidence. The fishes in this batch were taken from a rocky pool fed from the three springs

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in its close vicinity at the foot of the tors. The banks are in part earthy and are grown with grasses and the flora usually found on the banks of rivers and streams in this area. The pool is 12 by 10 feet wide and knee deep. The bed is rocky. The altitude of the pool would be roughly 2,100 feet above sea level.

i. *Rasbora daniconius* (Ham.) ... ... 7 specimens.
ii. *Parapsilorhynchus* (new species) ... ... 37 specimens.
iii. *Lepidocephalichthys guntea* (Ham.) ... ... 1 specimen.
iv. *Nemachilus evezardi* Day ... ... 22 specimens.

15. Quarry Tank, at the end of Dhondy Road, Deolali Cantonment; 19-9-1935.

These fishes were taken from a quarry accumulation of water brought about by blasting operations carried out sometime in the past. As a result of these operations either a spring or some sub-soil source of water supply has been tapped and the ooze from below has made the area into a permanently filled tank. Obviously because of its potentialities for breeding mosquitoes this tank has been stocked with fish. No information is available as to when the tank became thus artificially formed; nor is the year known when the fishes were put into it. At present the water in it is not used for any purpose and is left neglected except for the regular visits paid to it by the Anti-Malarial Squad who examine it for the presence of mosquito larvae. These however appear not to be able to thrive in it owing to the presence of the fishes. The water accumulation as it now exists presents the form of nearly a square about 40 by 50 feet. Its depth would be about 25 feet from the surface of the banks. The depth of the water is well over 12 feet. It consists of practically solid basalt rock save for the earthy strata upon the banks. At the south end a section of the bank slopes down to the water edge and has a base of rock overlaid by a surface layer of earth. The rest of the bank is steeply upright from the surface of the water and is grass-grown. The water in it is dirty looking with a scum and algae floating on its surface. It is now teeming with a new species of *Rasbora* which do not appear to have suffered by the change in environment from that of a running stream to a still water tank. The nearest stream is the 'North Nallah' which is three furlongs distant from this tank. I mention this fact in order to support the statement that the tank must have been stocked with this species, as there is no connection between it and the North Nalla unless it be a subterranean one. I have failed to discover any other species in it.

i. *Rasbora labiosa* Mukerji ... ... 74 specimens.

16. The Aounda river, west of the road bridge between Aswali Railway Station and Lake Beale; 29-9-1935.

The road bridge mentioned is one mile and a furlong from Lake Beale and the 'Aounda' river courses under it and meanders on due east until it joins the river 'Darna' below the dam. The 'Aounda' river has its origin in the heights south of 'Anjem'. These heights are the southerly ranges extending in an easterly direction towards 'Ambli' at an average height of 4,000 feet above the sea level. The springs and the drainage from the northern face of these heights help to swell the 'Waldi' river, while those on the southern aspects feed the river 'Aounda', flowing from it in a southerly direction until it meets the 'Kharki' nallah some ten miles south of its origin. About four miles north above the point of junction with the 'Kharki' nallah, near to a village called 'Raju' the 'Aounda' is joined by two other tributary nallahs, namely, the 'Choni' and 'Kohki' nallahs, all of which flow south and are perennial streams adding to its volume. The river 'Aounda', in its extent, is roughly 25 miles in all up to its junction with the river 'Darna'. From the junction with the 'Kharki' nallah the course is irregular. It flows south-east for a mile or so and then turns north for 3 to 4 miles, after which it meanders in a south-easterly direction and finally due east up to the junction with the 'Darna'. In the stretch explored, west of the road bridge referred to, the river flows from west to east. Here are the remains of a former road bridge which at some remote period must have been washed away

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by a flood, as there are breaches in its length and the masonry bases of the piles supporting the former structure are now submerged. The existing masonry remains uprise from the river banks on either side to a height of ten feet. These show evidence of considerable erosion. West of this ruined bridge is a large expanse of water about one hundred yards long and 60 feet broad with a varying depth of 2 feet at the sides to 4 feet midstream. The fishes in this batch were taken from this section. The north bank is earthy and grown with vegetation and heavily wooded with *'babul'* (gum acacia). The relative height of this bank to the bed of the river is about 25 feet. The south bank in its total extent is shelved with basalt rock sloping to the river's edge. Above this rocky plinth there is an earthy stratum rising to a height varying from 15 to 20 feet. This bank is bordered by fields under cultivation. The bed of the river is rocky and sanded for the greater portion of its width except for the shallows of the north bank which is silted up. The river was moderately swollen with muddy storm water at the time of the visit. The volume and flow were full and strong in midstream. The altitude is roughly 1,800 feet above sea level.

i.	*Chela clupeoides* (Bloch)	2 specimens.
ii.	*Barilius bendelisis* Ham.	1 specimen.
iii.	*Rasbora daniconius* (Ham.)	2 specimens.
iv.	*Barbus amphibius* (C. & V.)	1 specimen.
v.	*Barbus chrysopoma* C. & V.	1 specimen.
vi.	*Barbus kolus* Sykes	1 specimen.
vii.	*Barbus ticto* (Ham.)	1 specimen.
viii.	*Garra mullya* (Sykes)	6 specimens.
ix.	*Labeo calbasu* (Ham.)	1 specimen.
x.	*Labeo porcellus* (Heckel)	5 specimens.
xi.	*Mystus cavasius* (Ham.)	1 specimen.
xii.	*Ambassia ranga* (Ham.)	1 specimen.
xiii.	*Glossogobius giuris* (Ham.)	3 specimens.

17. The Aounda river, ¼ mile west of Lake Beale Dam; 6-10-1935.

The stretch of water is some 120 yards long and of a uniform width of nearly 60 feet. The river in this section flows in a slightly north-easterly direction. The depth is from 2 feet at the sides to roughly 6 feet midstream. There is a good volume of water flowing through with a strong centrally running current. The water was slightly turbid with mud. The south-east bank is in part an earth embankment 12 to 18 feet high and is grown with long grass and a few *'babul'* trees. It is bordered with cultivated fields. The continuity of this bank then gives place to rocky plinths which slope to the water edge and in parts are precipitous up to a height of 5 to 10 feet. The opposite bank is for the whole length of this section a sanded beach 40 feet wide; and more inland to this it is earthy and grown with grasses and heavily wooded with acacia (*babul*). The bed of the river on the side of the north-west bank is sanded and the south-east bank is silted up in parts and where the rocky plinth begins it is composed of rock and sand. Midstream it is silted. There are no villages in this locality. The altitude above the sea level is 1,800 feet.

i.	*Labeo porcellus* (Heckel)	1 specimen.
ii.	*Mystus cavasius* (Ham.)	4 specimens.

18. Pool at the head of a nallah draining into the Aounda river; 6-10-1935.

The length of this 'Nallah' stream is not more than two furlongs and the spring and the pool formed by it are just below the road running from Lake Beale Dam to 'Aswali' railway station (G.I.P.R.). The stream begins here and in its course is of a varying width but never more than 8 feet in its broadest section. It is ankle deep in some parts and in other sections barely a few inches. The bed of the 'Nallah' has a steep gradient and is practically rock throughout its whole length except near

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to its junction with the 'Aounda' river. It runs through cultivated fields of '*bajri*'. The height of the pool above the river Aounda is at least 50 feet. The volume and flow are poor. The bed of the pool is rock and its depth is 2 feet. The width and breadth is 10 by 12 feet.

i. *Danio acquipinnatus* (McClell.) ... ... 1 specimen.
ii. *Rasbora daniconius* (Ham.) ... ... 27 specimens.
iii. *Barbus amphibius* (C. & V.) ... ... 18 specimens.

19. Section of the Aounda river, 5 miles west of Lake Beale Dam; 15-10-1935.

The river here bends from under the railway track, which is bridged over, and curving northward reaches after a 5 furlongs run the site from which the fish were collected. The direction of the river at this point is due north. The volume of the water was great and at the time of the visit the river was swollen with muddy storm waters, with the force of the current directed against the west bank. The east bank is a pebbled stretch of a length of 40 and a breadth of 20 feet. From this beach to a height of 10 feet is an earth embankment overgrown with grass and bordered by fields under cultivation (*bajri* crop). The opposite bank is all shelving rock. In the high sections of this rocky base are some sparsely grown patches of grass. The bed of the river is pebbled throughout. The depth of the water is from 2 feet at the sides to 4 feet midstream. The largest fish in this batch weighing when caught 1 lb. and 2 oz. was taken near the edge of the west bank. Here the bed is rocky and sanded, but at the water's edge there was a growth of rushes, which was localised to a small patch where there is a gathering of silt.

i. *Barilius bendelisis* Ham. ... ... 2 specimens.
ii. *Rasbora daniconius* (Ham.) ... ... 2 specimens.
iii. *Barbus khudree* Sykes ... ... 1 specimen.
iv. *Barbus kolus* Sykes ... ... 1 specimen.
v. *Barbus melanostigma* Day ... ... 3 specimens.
vi. *Barbus pinnauratus* Day ... ... 4 specimens.
vii. *Barbus ticto* (Ham.) ... ... 1 specimen.
viii. *Garra mullya* (Sykes) ... ... 3 specimens.
ix. *Labeo boggut* (Sykes) ... ... 2 specimens.
x. *Nangra viridescens* (Ham.) ... ... 2 specimens.
xi. *Glossogobius giuris* (Ham.) ... ... 1 specimen.

20. & 21. West side sloping rocky channel which conducts the released waters from Lake Beale *via* the Dam directly into the river Darna at the point of its junction with the Aounda river; 15-10-1935.

Lake Beale, (named after the Engineer who built the dam) is 17 miles long and 2 miles broad in its widest section. The dam was built across the course of the river 'Darna' in 1912 and converted a large area of the depression through which the 'Darna' river originally coursed into a lake. The dam is about one mile in extent and on an average 40 feet in height. The depth of water in the lake against the dam is from 8 to 10 feet. From the dam the waters rush over a wide and steep rocky bed interspersed with large boulders of basalt rock and become divided into two streams; one on the west side and the other on the east side of the wide rocky bed. The fishes were caught in the west channel which is 30 feet wide and about 2 furlongs in extent. Owing to the steep gradient of the rocky bed the waters swirl down in a roaring torrent. When there is an increased volume of water flowing through this channel from the lake it is dangerous for a man to negotiate a passage through it. Bhil fishermen however manage to do so only at a certain point, where a section of this channel, about midway in its length, levels out for 10 feet or more and here in this patch the fishermen cast their nets regularly every evening with the certainty of securing fishes of large size weighing up to 3 lb. The gates of the dam are opened regularly during the monsoon months and occasionally during the dry months and at

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the time of the visit the water flowing through the channel was in great volume owing to some of the gates on the west side of the dam having been opened. In the level patch referred to above, the depth of the water depends upon the volume rushing through it. It may be knee deep or at its greatest height about 3 feet or more. At the end of the 2 furlongs run the channels below the dam, which constitute the river 'Darna', are joined by the river 'Aounda' and this junction creates a wide expanse of water seething and foaming with swirling currents rushing over beds of pure rock without evidence of any vegetation on its banks. The altitude of the dam is 1,875 feet and the levels of the junction of the two rivers would be 1,800 feet.

i.	*Chela clupeoides* (Bloch)	10 specimens.
ii.	*Barbus khudree* Sykes	1 specimen.
iii.	*Barbus kolus* Sykes	3 specimens.
iv.	*Barbus sarana* (Ham.)	2 specimens.
v.	*Wallago attu* (Bloch)	1 specimen.
vi.	*Ambassis ranga* (Ham.)	5 specimens.
vii.	*Glossogobius giuris* (Ham.)	3 specimens.

22. The Darna river at its junction with the Aounda river at the point where the rocky channel conducting waters from Lake Beale levels out with the Darna river; 20-10-1935.

The wide expanse of waters at the junction of the two rivers mentioned is roughly 120 yards broad and about 2 furlongs in extent. It is an area composed mostly of rock. The north bank is in part a sanded beach giving place to sloping rocks and interspersed with large boulders. The river 'Aounda' section is less agitated by the currents and becomes turbulent when joined by the furious waters from the 'Darna' river channels which conduct the released waters from Lake Beale. The average depth is 3 feet but midstream in the wide expanse it is from 6 to 8 feet in certain parts. There is no vegetation on the banks.

i.	*Chela clupeoides* (Bloch)	6 specimens.
ii.	*Chela phulo* (Ham.)	3 specimens.
iii.	*Rasbora daniconius* (Ham.)	1 specimen.
iv.	*Barbus amphibius* (C. & V.)	7 specimens.
v.	*Barbus pinnauratus* Day	1 specimen.
vi.	*Barbus sarana* (Ham.)	2 specimens.
vii.	*Crossochilus latius* (Ham.)	1 specimen.
viii.	*Garra mullya* (Sykes)	2 specimens.
ix.	*Labeo porcellus* (Heckel)	2 specimens.
x.	*Rohtee duvaucelii* (C. & V.)	1 specimen.
xi.	*Mystus cavasius* (Ham.)	2 specimens.
xii.	*Ambassis nama* (Ham.)	4 specimens.
xiii.	*Ambassis ranga* (Ham.)	104 specimens.
xiv.	*Glossogobius giuris* (Ham.)	5 specimens.

23. The Godaveri river, 1 mile east of the Indore road bridge east of Nasik city; 29-10-1935.

The river in this section flows due east, and it is moderately swollen with storm waters and the force of the current is directed against the north bank owing to a slight bend in the run. The north bank rises 25 feet above the water level and it is composed of a rocky base of about 10 feet with an earthy layer of 15 feet above. The south bank is on an average 20 feet above a sanded beach which is 30 yards broad. The width of the river is roughly 110 feet. I am told that when the river is in flood the expanse of the river is then 200 feet and nearly reaches the top of both the north and south banks. At the time of the visit the waters had receded and the sanded beach referred to above had become exposed. The land in the precints of both the banks is grown with fruit orchards—grape vineyards, guava, plantains, and citrons. On the banks there are many tamarind and *babul* trees. The

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bed of the river is pebbled and silted up. The depth is on an average 2 feet on the south bank edges, midstream it must be 3 to 4 feet and 6 feet towards the north bank edge. The height above sea level is 1,300 feet.

i.	*Chela clupeoides* (Bloch)	13 specimens.
ii.	*Chela phulo* (Ham.)	8 specimens.
iii.	*Barilius bendelisis* Ham.	7 specimens.
iv.	*Danio aequipinnatus* (McClell.)	4 specimens.
v.	*Rasbora daniconius* (Ham.)	3 specimens.
vi.	*Barbus khudree* Sykes	7 specimens.
vii.	*Barbus kolus* Sykes	2 specimens.
viii.	*Barbus ticto* (Ham.)	5 specimens.
ix.	*Crossochilus latius* (Ham.)	2 specimens.
x.	*Garra mullya* (Sykes)	16 specimens.
xi.	*Labeo boggut* (Sykes)	1 specimen.
xii.	*Rohtee cotio* (Ham.)	1 specimen.
xiii.	*Nemachilus botius* (Ham.)	1 specimen.
xiv.	*Nemachilus evezardi* Day.	15 specimens.
xv.	*Glyptothorax lunah* (Sykes)	1 specimen.
xvi.	*Ophicephalus gachua* Ham.	1 specimen.
xvii.	*Ambassis ranga* (Ham.)	1 specimen.
xviii.	*Glossogobius giuris* (Ham.)	9 specimens.

24. North Nallah stream, from pools below the Deolali Cantonment Bazaar; 31-10-1935.

For description, see the account of locality No. 1.

i.	*Barilius bendelisis* Ham.	105 specimens.
ii.	*Rasbora labiosa* Mukerji	27 specimens.
iii.	*Barbus ticto* (Ham.)	2 specimens.
iv.	*Garra mullya* (Sykes)	2 specimens.
v.	*Lepidocephalichthys guntea* (Ham.)	19 specimens.
vi.	*Nemachilus denisonii* Day	1 specimen.
vii.	*Nemachilus evezardi* Day	2 specimens.

25. Middle section of the Narsullah Wadi running through Barnes High School estate; 1-11-1935.

For description, see the account of locality No. 10.

i.	*Rasbora labiosa* Mukerji	118 specimens.
ii.	*Barbus ticto* (Ham.)	3 specimens.
iii.	*Garra mullya* (Sykes)	1 specimen.
iv.	*Lepidocephalichthys guntea* (Ham.)	17 specimens.

26. Section of the Darna river at its junction with the Waldi river up to the village of Chedi; 7-11-1935.

The river has subsided but still flows with very strong currents which are particularly forceful near the bridge. The depth of the run is on an average, midstream, about 3 feet with shallows of one foot at the sides. The force of the current is against the south bank. Both the banks are earthy and shelving down to sandy beaches about 30 feet wide on either side. The north bank leading down from the village of Chedi has a more extensive pebbled beach (approximately 30 yards), which during the rains is submerged but is now dry. The bed of the river is pebbled throughout and in parts is silted up.

i.	*Chela clupeoides* (Bloch)	1 specimen.
ii.	*Barilius bendelisis* Ham.	6 specimens.
iii.	*Rasbora labiosa* Mukerji	1 specimen.
iv.	*Barbus khudree* Sykes	1 specimen.
v.	*Barbus sarana* (Ham.)	1 specimen.
vi.	*Barbus ticto* (Ham.)	16 specimens.
vii.	*Garra mullya* (Sykes)	2 specimens.

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viii. *Nemachilus botius* (Ham.) ... ... 4 specimens.
ix. *Ambassis ranga* (Ham.) ... ... 6 specimens.
x. *Glossogobius giuris* (Ham.) ... ... 3 specimens.

27. The Waldi river near the villages of Deolali and Edhgaon; 14-11-1935.

The Waldi river here flows from west to east and the villages of Edhgaon and Deolali lie on the south and north bank respectively. The banks and the bed of the river are composed of basalt rock throughout. The flow and volume of water in the river are strong and good. The depth is from 2 feet at the sides to 3 feet midstream. The width is from 40 to 50 feet. The height above sea level is about 1,850 feet. The height of the banks from the bed of the river is about 30 feet.

i. *Barilius bendelisis* Ham. ... ... 25 specimens.
ii. *Danio aequipinnatus* (McClell.) ... ... 2 specimens.
iii. *Barbus khudree* Sykes ... ... 3 specimens.
iv. *Barbus ticto* (Ham.) ... ... 11 specimens.
v. *Garra mullya* (Sykes) ... ... 41 specimens.
vi. *Nemachilus botius* (Ham.) ... ... 2 specimens.

28. The Godaveri river, one mile east of the Indore Road Bridge east of Nasik city; 8-12-1935.

Since the last visit (*vide* locality No. 22) the river has considerably subsided and the pebbled beach is exposed and is covered with a layer of silt. This beach inclines down from the south bank to the water's edge and in extent would be 150 feet broad and 100 yards or more in length. The force of the very sluggish flow is against the north bank and there is a large amount of green algae in evidence, fragments are seen floating in the surface scum and the water generally is very filthy looking and ashen in colour. The depth of the water in its deepest part against the north bank is $3\frac{1}{2}$ feet and in the shallows of the edge against the south beach it is barely a foot in depth. The beach referred to above is being ploughed up and in parts of it cucumber and water melons seeds are being sown. All the specimens of the species *Barbus ticto*—Bhil name 'Tiptoo'—taken on this day in this section of the river showed a scarlet pigmentation of the body scales and the caudal and dorsal fins were similarly stained. They have lost this colouration in spirits.

i. *Barilius bendelisis* Ham. ... ... 3 specimens.
ii. *Garra mullya* (Sykes) ... ... 1 specimen.
iii. *Barbus khudree* Sykes ... ... 7 specimens.
iv. *Barbus kolus* Sykes ... ... 5 specimens.
v. *Barbus ticto* (Ham.) ... ... 27 specimens.

29. Pool in the course of the North Nallah; 14-12-1935.

This pool is a small one about 30 by 40 feet and from 2 to 3 feet in depth. The bed is all rocky and so are the banks on either side. There is no vegetation in the locality. It is roughly one mile and a half from the junction of the 'North Nallah' with the Darna river. It is 1,830 feet above sea level.

i. *Barilius bendelisis* Ham. ... ... 9 specimens.
ii. *Danio aequipinnatus* (McClell.) ... ... 26 specimens.
iii. *Rasbora daniconius* (Ham.) ... ... 5 specimens.
iv. *Barbus ticto* (Ham.) ... ... 141 specimens.
v. *Garra mullya* (Sykes) ... ... 1 specimen.
vi. *Lepidocephalichthys guntea* (Ham.) ... ... 2 specimens.

30. The Darna river, 1 mile from Ghote Railway Station, 26-12-1935.

Here the river Darna is about 50 yards wide. The current is strong midstream and the relative heights of the banks above the water's level are 10 to 15 feet. The banks are grown with the usual and varied flora. The

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bed of the river is silted up and appears to be earthy. The depth midstream is about 6 feet and 2 feet at the sides. The height above sea level is roughly 1,950 feet.

i. *Chela clupeoides* (Bloch) ... ... 1 specimen.
ii. *Barbus amphibius* (C. & V.) ... ... 13 specimens.
iii. *Barbus sarana* (Ham.) ... ... 2 specimens.
iv. *Barbus ticto* (Ham.) ... ... 3 specimens.
v. *Lepidocephalichthys guntea* (Ham.) ... ... 3 specimens.
vi. *Ambassis ranga* (Ham.) ... ... 7 specimens.

31. The Darna river, one furlong from Ghote Railway Station; 28-12-1935.

Here the river is about 60 yards wide and curves northwards parallel with the railway track. It is about a furlong from the Railway Station. The banks are rocky in the greater part of this section and the bed at the river edge is composed of rocky plinths, parts of which are silted. The current is strong midstream and the depth must be at least eight feet. At the edge of the river on the west bank the depth is from 2 to 3 feet and it suddenly deepens towards the middle. The height above sea level would be about 1,900 feet.

i. *Chela clupeoides* (Bloch) ... ... 3 specimens.
ii *Danio aequipinnatus* (McClell.) ... ... 6 specimens.
iii. *Rasbora daniconius* (Ham.) ... ... 8 specimens.
iv. *Barbus amphibius* (C. & V.) ... ... 8 specimens.
v. *Barbus pinnauratus* Day ... ... 1 specimen.
vi. *Barbus ticto* (Ham.) ... ... 18 specimens.
vii. *Garra mullya* (Sykes) ... ... 122 specimens.
viii. *Rohtee duvaucelii* (C. & V.) ... ... 1 specimen.
ix. *Nemachilus botius* (Ham.) ... ... 3 specimens.
x. *Mystus cavasius* (Ham.) ... ... 22 specimens.
xi. *Ophicephalus gachua* Ham. ... ... 2 specimens.
xii. *Ambassis ranga* (Ham.) ... ... 9 specimens.

32. Section of the North Nallah which runs by Deolali Cantonment Bazaar; 2-1-1936.

All these fishes were caught in a section of the 'North Nallah' which runs by the Deolali Cantonment Bazaar. Here the water is strongly alkaline to litmus paper. The depth of water in the stream is from ½ to 2 feet and the bed is silted over a rocky base. There is much washing of clothes done at this point and the water is soapy and foul smelling as it tends to stagnate owing to a sluggish surface flow. In the silt, particularly at the edges of the stream, worms can be found at all times of the year. It was observed that *Barilius bendelisis* partly buried themselves in the silt in order to hide and escape our efforts to catch them and it was found easier to simply lift the silt and then pick out the fishes buried in it. It was then also discovered that worms were present in the silt.

i. *Barilius bendelisis* Ham. ... ... 64 specimens.

33. Lower section of Narsullah Wadi, near to Bagoor village; 8-1-1936.

For description, see account of locality No. 10.

i. *Barilius bendelisis* Ham. ... ... 6 specimens.
ii. *Danio aequipinnatus* (McClell.) ... ... 5 specimens.
iii. *Rasbora daniconius* (Ham.) ... ... 7 specimens.
iv. *Aspidoparia morar* (Ham.) ... ... 1 specimen.
v. *Barbus khudree* Sykes ... ... 2 specimens.
vi. *Barbus ticto* (Ham.) ... ... 33 specimens.
vii. *Garra mullya* (Sykes) ... ... 4 specimens.
viii. *Nemachilus botius* (Ham.) ... ... 1 specimen.
ix. *Ophicephalus gachua* Ham, ... 6 specimens.

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34. Pool in the course of the North Nallah; 10-1-1936.

For description, see account of locality No. 28.

i. *Barilius bendelisis* Ham. ... ... 3 specimens.
ii. *Danio aequipinnatus* (McClell.) ... ... 2 specimens.
iii. *Rasbora labiosa* Mukerji ... ... 13 specimens.
iv. *Barbus ticto* (Ham.) ... ... 12 specimens.
v. *Lepidocephalichthys guntea* (Ham.) ... ... 1 specimen.
vi. *Nemachilus denisonii* Day ... ... 1 specimen.
vii. *Nemachilus evezardi* Day ... ... 8 specimens.

35. One furlong run above the 10 feet Dam in the middle section of the Narsullah Wadi; 19-1-1936.

For description, see account of locality No. 10.

i. *Barilius bendelisis* Ham. ... ... 2 specimens.
ii. *Danio aequipinnatus* (McClell.) ... ... 1 specimen.
iii. *Rasbora daniconius* (Ham.) ... ... 21 specimens.
iv. *Rasbora labiosa* Mukerji ... ... 9 specimens.
v. *Barbus ticto* (Ham.) ... ... 75 specimens.
vi. *Garra mullya* (Sykes) ... ... 11 specimens.
vii. *Parapsilorhynchus* (New species) ... ... 19 specimens.
viii. *Lepidocephalichthys guntea* (Ham.) ... ... 3 specimens.
ix. *Nemachilus evezardi* Day ... ... 4 specimens.
x. *Ophicephalus gachua* Ham. ... ... 1 specimen.

36. The Darna river, near the village of Sewnsuri; 30-1-1936.

For description, see account of locality No. 12.

i. *Barilius bendelisis* Ham. ... ... 6 specimens.
ii. *Rasbora daniconius* (Ham.) ... ... 1 specimen.
iii. *Barbus khudree* Sykes ... ... 8 specimens.
iv. *Barbus kolus* Sykes ... ... 1 specimen.
v. *Barbus ticto* (Ham.) ... ... 28 specimens.
vi. *Garra mullya* (Sykes) ... ... 11 specimens.
vii. *Labeo porcellus* (Heckel) ... ... 1 specimen.
viii. *Nemachilus botius* (Ham.) ... ... 2 specimens.
ix. *Glossogobius giuris* (Ham.) ... ... 1 specimen.

37. The Darna river, near the village Sewnsuri; 30-1-1936.

The fish were caught at the sides of the river in a portion of it which was but a few inches deep and where there was no current. The bed was a silt-covered sanded section and water was strongly alkaline to litmus paper while the temperature of the water in this particular spot at 3 p.m. was 86 degrees F. All of these specimens appear to be very young examples of *Barilius bendelisis*. Bhil name—'Jhor'.

i. *Barilius bendelisis* Ham. ... ... 21 specimens.

38. The Darna river, in the run south of Lahavit Railway Station; 4-2-1936.

The width of the river here is some 60 feet. The river flows from south-west to north-east. The banks are earthy and the height above the water level is 3 feet. The south bank is bordered with fields under cultivation while the north bank is wooded with *Babul* trees. The bed of the river is silted up over an earthy base and it is rankly overgrown with water weeds which at the edges of the river are 4 feet in length. The depth midstream must be 12 feet and at the edges 5 feet. The stretch itself is a straight run of about 2½ furlongs length and the current is particularly strong midstream. The height above sea level is 1,820 feet.

i. *Notopterus notopterus* (Pallas) ... ... 2 specimens.
ii. *Mastacembelus armatus* (Lacép.) ... ... 1 specimen.

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iii. *Anguilla anguilla* (Ham.) ... ... 1 specimen.
iv. *Danio aequipinnatus* (McClell.) ... ... 1 specimen.
v. *Rasbora daniconius* (Ham.) ... ... 4 specimens.
vi. *Barbus kolus* Sykes ... ... 1 specimen.
vii. *Barbus sarana* (Ham.) ... ... 2 specimens.
viii. *Cirrhina reba* (Ham.) ... ... 1 specimen.
ix. *Labeo boggut* (Sykes) ... ... 3 specimens.
x. *Labeo porcellus* (Heckel) ... ... 1 specimen.
xi. *Ophicephalus leucopunctatus* Sykes ... ... 1 specimen.

39. Pool in the course of North Nallah, below the Deolali Cantonment bazaar; 10-2-1936.

For description, see the account of locality No. 1.

i. *Barilius bendelisis* Ham. ... ...89 specimens.
ii. *Danio aequipinnatus* (McClell.) ... ... 1 specimen.
iii. *Rasbora labiosa* Mukerji ... ... 70 specimens.
iv. *Barbus ticto* (Ham.) ... ... 1 specimen.
v. *Garra mullya* (Sykes) ... ... 2 specimens.
vi. *Lepidocephalichthys guntea* (Ham.) ... ... 4 specimens.
vii. *Nemachilus denisonii* Day ... ... 2 specimens.

40. East channel, below Lake Beale Dam; 24-2-1936.

The east channel courses down at a steep gradient but midway there is a section of the run which levels out for about 50 yards and here there is a good growth of the usual flora on the banks and the area is wooded with *Babul* trees. This stretch was explored at a time when the sluice gates were open and the channel was rushing and roaring with the torrents. The bed here is composed of rock throughout and the depth varies from 2 to 4 feet. The volume and force of the current was full and very strong. The width of the channel is from 6 feet to 40 feet in the level area. The total length of the channel from the sluice gates to where the waters once again level out at a point some 200 yards below the junction of the west channel with the Aounda river is roughly 3 furlongs. The gradient is less steep than that of the west channel and the whole of it is practically rock throughout. The distance between the west and east channels corresponds to the length of Lake Beale Dam itself. In between are some small rills and collections of water which are of no importance and the whole of the area consists of basalt rock plinths and boulders of large size.

For other particulars see the notes connected with locality No. 20.

i. *Chela phulo* (Ham.) ... ... 7 specimens.
ii. *Rasbora daniconius* (Ham.) ... ... 8 specimens.
iii. *Barbus amphibius* (C. & V.) ... ... 1 specimen.
iv. *Barbus khudree* Sykes ... ... 2 specimens.
v. *Barbus kolus* Sykes ... ... 1 specimen.
vi. *Barbus ticto* (Ham.) ... ... 7 specimens.
vii. *Cirrhina reba* (Ham.) ... ... 16 specimens.
viii. *Garra mullya* (Sykes) ... ... 7 specimens.
ix. *Labeo boggut* (Sykes) ... ... 5 specimens.
x. *Lepidocephalichthys guntea* (Ham.) ... ... 1 specimen.
xi. *Nemachilus botius* (Ham.) ... ... 1 specimen.
xii. *Callichrous bimaculatus* (Bloch) ... ... 3 specimens.
xiii. *Mystus cavasius* (Ham.) ... ... 1 specimen.
xiv. *Ophicephalus gachua* Ham. ... ... 1 specimen.
xv. *Ophicephalus marulius* Ham. ... . 1 specimen.
xvi. *Ambassis baculis* (Ham.) ... ... 2 specimens.
xvii. *Ambassis nama* (Ham.) ... ... 6 specimens.
xviii. *Ambassis ranga* (Ham.) ... ... 24 specimens.
xix. *Glossogobius giuris* (Ham.) ... ... 37 specimens.

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41. The Darna river, between the village of Sewnsuri and Deladgaon; 7-3-1936.

On the day of the visit there was only one main stream and this flowed directly by the east bank. The current was strong and full but with a less volume of water. The width was also slightly less.

i. *Chela clupeoides* (Bloch) ... ... 11 specimens.
ii. *Barilius bendelisis* Ham. ... ... 97 specimens.
iii. *Rasbora daniconius* (Ham.) ... ... 2 specimens.
iv. *Aspidoparia morar* (Ham.) ... ... 24 specimens.
v. *Barbus khudree* Sykes ... ... 45 specimens.
vi. *Barbus kolus* Sykes ... ... 5 specimens.
vii. *Barbus sarana* (Ham.) ... ... 2 specimens.
viii. *Barbus ticto* (Ham.) ... ... 3 specimens.
ix. *Crossochilus latius* (Ham.) ... ... 3 specimens.
x. *Garra mullya* (Sykes) ... ... 93 specimens.
xi. *Labeo boggut* (Sykes) ... ... 28 specimens.

42. The Darna river between the villages of Sewnsuri and Beladgaon; 18-3-1936.

For description, see account of locality No. 8.

i. *Chela phulo* (Ham.) ... ... 6 specimens.
ii. *Barilius bendelisis* Ham. ... ... 8 specimens.
iii. *Danio aequipinnatus* (McClell.) ... ... 8 specimens.
iv. *Rasbora daniconius* (Ham.) ... ... 1 specimen.
v. *Aspidoparia morar* (Ham.) ... ... 2 specimens.
vi. *Barbus khudree* Sykes ... ... 6 specimens.
vii. *Barbus sarana* (Ham.) ... ... 2 specimens.
viii. *Garra mullya* (Sykes) ... ... 19 specimens.
ix. *Labeo boggut* (Sykes) ... ... 8 specimens.

43. Pool in the course of the North Nallah; 29-3-1936.

For description, see account of locality No. 29.

i. *Barilius bendelisis* Ham. ... ... 23 specimens.
ii. *Danio aequipinnatus* (McClell.) ... ... 2 specimens.
iii. *Barbus ticto* (Ham.) ... ... 12 specimens.

44. Pool in the course of the North Nallah; 15-4-1936.

For description, see account of locality No. 29.

i. *Barilius bendelisis* Ham. ... ... 5 specimens.
ii. *Rasbora daniconius* (Ham.) ... ... 1 specimen.
iii. *Barbus ticto* (Ham.) ... ... 126 specimens.
iv. *Garra mullya* (Sykes) ... ... 4 specimens.

45. Pool in the course of the North Nallah; 20-5-1936.

For description, see account of locality No. 29.

i. *Barilius bendelisis* Ham. ... ... 19 specimens.
ii. *Rasbora labiosa* Mukerji ... ... 31 specimens.
iii. *Garra mullya* (Sykes) ... ... 10 specimens.
iv. *Lepidocephalichthys guntea* (Ham.) ... ... 1 specimen.

46. The Darna river, near Lahavit; 28-4-1936.

For description, see account of locality No. 38.

i. *Barilius bendelisis* Ham. ... ... 1 specimen.
ii. *Barbus khudree* Sykes ... ... 1 specimen.
iii. *Barbus kolus* Sykes ... ... 6 specimens.
iv. *Barbus parrah* (Day) ... ... 1 specimen.
v. *Labeo porcellus* (Heckel) ... ... 5 specimens.
vi. *Rohtee vigorsii* Sykes ... ... 3 specimens.
vii. *Wallago attu* (Bloch) ... ... 1 specimen.
viii. *Mystus cavasius* (Ham.) ... ... 5 specimens

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47. The Darna river, between the village of Sewnsuri and Beladgaon; 29-4-1936.

For description, see account of locality No. 8.

i.	*Barilius bendelisis* Ham.	... 3 specimens.
ii.	*Barbus khudree* Sykes	... 3 specimens.
iii.	*Barbus kolus* Sykes	... 19 specimens.
iv.	*Barbus melanostigma* Day	... 1 specimen.
v.	*Barbus sarana* (Ham.)	... 3 specimens.
vi.	*Garra mullya* (Sykes)	... 1 specimen.
vii.	*Labeo porcellus* (Heckel).	... 4 specimens.
viii.	*Glossogobius giuris* (Ham.)	... 1 specimen.

48. The Darna river, near Lahavit Railway Station; 3-5-1936.

For description, see account of locality No. 38.

i.	*Barbus khudree* Sykes	... 3 specimens.
ii.	*Barbus kolus* Sykes	... 4 specimens.
iii.	*Barbus sarana* (Ham.)	... 1 specimen.
iv.	*Labeo porcellus* (Heckel).	... 3 specimens.
v.	*Glossogobius giuris* (Ham.)	... 1 specimen.

49. The Darna river, near Lahavit Railway Station; 10-5-1936.

For description, see account of locality No. 38.

i.	*Chela clupeoides* (Bloch)	... 2 specimens.
ii.	*Barbus kolus* Sykes	... 8 specimens.
iii.	*Barbus sarana* (Ham.)	... 1 specimen.
iv.	*Labeo porcellus* (Heckel)	... 3 specimens.
v.	*Rohtee vigorsii* Sykes	... 1 specimen.
vi.	*Mystus cavasius* (Ham.)	... 22 specimens.

50. Section of the North Nallah, below the Deolali Cantonment bazaar; 20-5-1936.

On this date this section of the 'North Nallah' contained a small amount of water confined to a channel which was 5 feet in width and was eight inches deep. There was no flow and the continuity of the channel had dried up below it for about 40 yards. The water was stagnant and foul smelling and strongly alkaline to litmus paper and the temperature of the water at 2 p.m. was 96° F.

i.	*Barilius bendelisis* Ham.	... 74 specimens.
ii.	*Rasbora labiosa* Mukerji	... 2 specimens.
iii.	*Parapsilorhynchus* (new species)	... 1 specimen.

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THE BIRDS OF BOMBAY AND SALSETTE.

BY

SÁLIM ALI and HUMAYUN ABDULALI.

PART II.

(With three plates).

(Continued from page 103 of this volume).

The Pied Bush-Chat : *Saxicola caprata atrata* Blyth.

Field identification : Size about that of a Sparrow. The male is jet black with white patches on the shoulders, particularly conspicuous in flight. The abdomen and base of tail both above and below are also white. The female is a soberly coloured brown bird with a patch of rusty reddish at the base of tail above, especially noticeable when on the wing. Frequents bare stony and sparse scrub country in the neighbourhood of cultivation and habitations.

Specimens : Khandala birds examined by Whistler vide *J.B.N.H.S.*, xxxviii, p. 284.

EHA, both in *The Common Birds of Bombay* and in *Nests & Eggs* (ii, 42) says that the Pied Bush-chat is to be found 'across the Harbour' and that it 'retires to the hills to breed'. Though not actually observed in Salsette, S. A. has a record of a pair seen on the out-skirts of a babool jungle near Kihim, on 17th September.

The *atrata* form is a common resident in the Ghats but as a bird seen at Nandur-Madhmeshwar, Niphad (Nāsik) during Christmas 1933 was almost certainly of the *bicolor* form, it is probable that the low country records for the cold weather refer largely to this northern migratory race.

Breeding : It breeds commonly in the Ghats from April to early June at Khandala, Panchgani and in the neighbouring country. We have also observed pairs at Arthur Hill Lake (Bhandardara) near Ghoti in May.

The nest is the usual pad of grass, hair, etc. placed under a stone or in a hoof-hole, in open or sparsely wooded country. Both parents assist in feeding the young. During the breeding season the male has a pretty song of several notes.

The Indian Stone-Chat : *Saxicola torquata indica* (Blyth).

Field identification : Size same as last—about that of a Sparrow. Males have a black head and a conspicuous white collar. The breast is reddish-brown and there is a white shoulder patch as in the foregoing. The female is plain brown and not unlike the female of the Pied Bush-chat except that it lacks the red patch at base of tail. Frequents cultivation and out-skirts, and open sparsely scrubbed country.

Specimens : *B.N.H.S.* ♀ ? 30-1-21 Santa Cruz (B.C.E.); ♂ 5-2-24 Andhēri (S.H.P.); ♂ 25-1-13 Santa Cruz (N.B.K.) *St. X. C.* : 157 Andhēri 7-11-33 ; 234 Andhēri 22-3-35 (H.A.).

This is a fairly common winter visitor—the two specimens 157 (7 November) and 234 (22 March) being our extreme dates—frequenting open uncultivated areas in the low country. Its habits are not unlike those of the Pied Bush-chat except that it appears to prefer a stone to a bush as a look-out post. Across the harbour it is also commonly met with while snipe-shooting as it does not appear to mind the wet, provided there is a sufficiency of sea-holly, or bunds to keep its feet dry. Sp. 157 collected in open waste land had fed on small beetles, and the general habitat of the bird leads one to believe that these must comprise a considerable proportion of its diet.

Breeding : Br. Navarro of St. Xavier's College, to whom we are indebted for many specimens and valuable information from Khandala and elsewhere,

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reports this bird as nesting at Khandala. He has procured the eggs, but in the absence of breeding specimens this will have to be confirmed.

The Wheatear : *Œnanthe deserti atrogularis* Blyth.

Field identification : Size slightly larger than that of a Sparrow. A pale sandy coloured bird with black wings and tail. Chin, throat and foreneck also black. A white shoulder patch and the pale whitish rump very conspicuous in flight. Female duller and brownish where male black. Inhabits open barren waste land with stones and sparse stunted thorn bushes.

Specimens : *B.N.H.S.* : 27-2-24 Pāli Hill, Bandra (S.A.); ♂ 12-11-12, ♂ 14-2-13 Santa Cruz (N.B.K.). *St. Xavier's Col.* : 21 Andhēri 3-1-33; 163 Andhēri 10-11-33 (H.A.).

In spite of the statement in the *New Fauna* to the effect that this bird is a winter visitor to the plains of North-West India only, it appears to be a sparse but regular visitor to our area. 12 November and 27 February are our earliest and latest dates. It frequents the same type of country as the last species, but does not venture into marshy land. It is also more terrestrial than the stone-chat, running on the ground for longer distances, and not returning as regularly to a favoured perch. Wheatears are active little birds; they wag their tails in the manner of wagtails. As a rule they are silent, but we have heard a male utter a loud 'cht-tt-tt'.

The Redstart : *Phœnicurus ochruros* subsp.

Field identification : Size about that of a Sparrow. Male black with orange-chestnut underparts from breast downwards. Tail and rump also this colour, particularly conspicuous in flight. Female plain brown with underparts and tail similar to but paler than in male. The tail is constantly shivered. Frequents open stony country and mango orchards.

Specimens : *B.N.H.S.* : 21-1-24 Andhēri (S.H.P.).

This is another regular winter visitor to our area though not occurring in any large numbers. Our earliest record is on 10 October and last on 15 March. At Panchgani, in the Ghats, the birds were extremely common as late as 26 March 1934. It frequents rocky, scrub-covered hillsides and broken country. It is also occasionally found in mango groves and such shady places where there is no under-growth.

Redstarts are seldom quiet. The body is continually dipped jerkily, and the tail flirted for no apparent reason, showing the flash of chestnut-red that gives them their name. Though redstarts find their food on the ground, they habitually fly into trees in the manner of tree-pipits when disturbed.

The Bluethroat : *Cyanosylvia suecica pallidogularis* Sarudny.

Field identification : Size somewhat smaller than that of a Sparrow. A pale brown bird with the appearance and bearing of the Indian Robin. Just before it leaves us in the hot weather the male acquires a blue throat. The tail and rump are orange chestnut and particularly conspicuous in flight. Inhabits the neighbourhood of swamps and well irrigated fields.

Specimens : *B.N.H.S.* : ♀ 26-12-1900 (EHA). *St. Xavier's Col.* : 222 January Andhēri.

Noted : Santa Cruz, Gōdhbunder, Powāi Lake, Rewās, etc.

This bird, a fairly common winter visitor to our area, is unlikely to be seen except by those who are optimistic enough to pursue snipe in the neighbourhood of Bombay. A terrific skulker, it revels in the security of dense growths of sea-holly (*Acanthus*), in salt and brackish marshes by tidal creeks, and in the coarse Polygonon and Cyperaceae that border fresh water pools and streams.

The earliest bird was noted by us on 15 November; the last on 5 March.

[**The Rubythroat** : *Calliope calliope* Pallas.

This is an East-Asiatic form that winters in eastern India, and also occasionally in Central India (*J.B.N.H.S.*, xxxvi, p.72). The only record from our area is that of Jerdon who mentions a specimen that 'took refuge on board ship a little south of Bombay'.]

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The Indian Robin : *Saxicoloides fulicata ptymatura* (Vieillot).

Local name : *Kala dumnat.*

Field identification : Size about that of a Sparrow. Male shiny black with white patches on the shoulders, often visible only in flight. A bright chestnut patch under the tail conspicuous on account of the bird's habit of holding its tail erect or cocked-up. Female dark brown with no white wing patches but with a paler chestnut patch under the tail. Usually pairs in open country near villages and cultivation.

Specimens : *B.N.H.S.* Several ; *St. X. C.* 29. Andhēri 3-8-33 (H.A.).

Resident. This is one of the most familiar birds of the low country, frequenting cultivated fields, fallow land in the vicinity of villages, scrub jungle and scrub-covered hills, quarries, ruins, and similar places. It is a tame and confiding bird, usually found in pairs, busily occupied in picking up insects from the ground. They occasionally perch on bushes but are essentially of terrestrial habits.

Breeding : The breeding season is from the end of March to the middle of June, the birds possibly being double-brooded. 2 or 3 eggs are laid in nests which are placed in holes, in cuttings, earth-banks, under stones, and in the roots of up-turned palmyra palms. In our area we have never come across a nest in a hollow tree-trunk or anywhere above ground-level, as so commonly seen elsewhere. A larger or smaller piece of snake-slough, is invariably included in the make-up of a nest. One nest examined was composed entirely of human hair. The birds build in the same locality year after year, but resent observation and will desert a nest if the least interest is shown in it.

The Magpie Robin : *Copsychus saularis saulfaris* Linn.

Local name : *Dominga ; Dhyal.*

Field identification : Size about that of a Bulbul. Back, head and breast black, wings and tail parti-coloured black and white, lower plumage white. In the female the black of the male is replaced by brown or ashy-brown. A familiar black-and-white songster usually seen with the tail cocked-up as in the Robin. Frequents gardens and the neighbourhood of habitations.

Specimens : *B.N.H.S.* Several from suburbs. *St. X. C.* : 5 Gōrēgāon 19-8-33 (H.A.).

Resident. This is another common bird of the low country, found in gardens and orchards, and in general replaces the last species where there are more trees than scrub. It is often found in heavy forest, and though a tree-dweller picks a considerable portion of its food off the ground. We have seen it eating snails and earth-worms. This last item is of interest as we have read somewhere that earth-worms are immune from the attacks of birds. This is one of our finest songsters and it is also an excellent mimic. We have for instance heard it imitate a 'did-he-do-it' to perfection.

Breeding : The males start singing from exposed perches about the middle of February, and the breeding season extends from March (Barnes) to June. The nest, a mere pad of fine twigs or leaf-stalks is placed in rafters, wells, hollow pipes, tree-stumps, wood-pecker holes, and holes in rotten palms. The usual clutch is of 5 eggs though occasionally only three are laid. The laying season coincides to some extent with the onset of the monsoon, and many nests are flooded out. The same site is used year after year.

On 7-5-30 H. A. found a nest in a date palm, containing the remains of a newly-hatched chick, which had apparently been killed and eaten by large black ants (*Camponotus* sp.). The birds laid again in the same nest and on the 20th there were 5 eggs.

The Indian Shama : *Kittacincla malabarica malabarica* (Scopoli).

Field identification : Size about that of a Bulbul. A black bird with a longish black-and-white tail and a white patch at the base of it above. Lower plumage from breast downwards bright chestnut. In the female the black is replaced by slaty-brown and the lower parts are considerably paler. A beautiful songster frequenting thick jungle, and more often heard than seen.

Specimens : *B.N.H.S.* juv. 9-9-28 (S. A.).

Noted : Karnala ; Kankēshwar ; Gōdhbunder.

This handsome bird, presumably a resident, is by no means common in our area. It keeps to the heavily forested portions of Salsette and the neighbouring Ghat country, frequenting dense under-growth, where it is not easily seen,

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Photos

Nest and chicks of the Indian Robin (*Saxicoloides fulicata*) in a derelict tin.

Sálim Ali

Nest of the Tailor Bird (*Orthotomus sutorius*) in leaf of monsoon plant, almost touching ground.

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Breeding: Our only record is a juvenile bird collected by S.A. on the Thāna-Gōdhbunder Road on 9 September 1928.

The Black-capped Blackbird: *Turdus simillimus mahrattensis* Whistler.

Field identification: Size of a Myna. A plain greyish-brown thrush with a black cap. The female is duller and has the cap less pronounced. The bill is pale orange and conspicuous. Singly in wooded country; on the ground or in trees.

Specimens: *B.N.H.S.*: 10-3-24 Pāli Hill; 21-3-24 Chembūr (S.A.)

Noted: Andhēri, Powāi, Bandra, Kihim, Uran, Rōha.

The Black-capped Blackbird wanders into our area from the Ghats during the non-breeding season i.e. from October to March. It is one of the regular habitués at the parties that gather on the blossoms of *Erythrina* and *Bombax*, and as such is commonest in the deciduous forest that covers the hillsides round Tūlsi Lake and farther north. Stray birds, are however not uncommonly met with in the low country, at Andhēri and Bandra. The song is not unlike a dhyal's but louder and richer. It is also an excellent mimic, with an exceptionally fine rendering of the plaintive cuckoo. It takes its food both on the ground and among the trees. On the ground it may be seen hopping about busily turning over dead leaves in the usual thrush-manner, in search of grubs and caterpillars. The stomach of a specimen contained the young petals and pollen grains of *Erythrina stricta*. Small parties may also be seen picking up the figs of the banyan, and during the cold weather they have been observed feeding largely on the berries of *Lantana camara* (Kihim). The fruit of the Jāmun (*Eugenia jambolana*) is largely eaten.

Breeding: It does not breed in our area except possibly on Tungar Hill, just across Bassein Creek, where the bird was common in evergreen patches in early April. In the Ghats, at Khandala, Panchgani, etc., it breeds in great numbers during the rains (June to August).

The White-throated Ground Thrush: *Geokichla citrina cyanotus* (Jardine and Selby).

Field identification: Size of a Myna. Orange-chestnut bird with bluish grey wings and tail which in the female are more brownish-olive. A white patch on the quills conspicuous in flight. Usually singly and shy in and about overgrown nullahs etc. in forest.

Specimens: *B.N.H.S.*: ♀ 6-6-06 Kalyan (J. Brand) ♂ 25-3-29 Tūlsi Lake (S.A.); ♂ *St. X. C.*: 12 Gōrēgāon 7-8-33 (H.A.).

Noted: Powāi, Borivli, Chembūr, etc.

This is another of the shy forest birds of our area which though not really rare are seldom seen except by those who leave the road and venture into the more remote regions. It is, as its name suggests, mainly a ground-haunting species, being found where there are plenty of leaves to turn over, and the degree of moistness necessary for a sufficiency of worms and insects. It also feeds on berries.

Breeding: Br. Navarro took a nest with c/4 at Powāi on 28 July, in a fork in a *Bridelia* tree about 10 feet from the ground. The nest is a rather shallow cup-shaped structure—reminiscent of a babbler's nest—of twigs, roots, etc. and for a thrush, with a very small quantity of mud used in its construction. On 20 June a bird was flushed off an empty nest on the Thāna-Gōdhbunder Road. It breeds commonly at Khandalla during the rains.

The Blue-headed Rock Thrush: *Monticola cinclorhyncha* (Vigors).

Field identification: Size of a Myna. 'Male easily recognized by the blue head and throat, chestnut rump and lower plumage and white patch in the wings; female brown with a scaled appearance and a rather conspicuous dark eye' (*Whistler*).

Specimens: *B.N.H.S.*: ♂ 25-3-29 Tūlsi Lake. (S.A).

Noted: Powāi; Khandala; Matheran (Sparrow Coll.); Panchgani (Fr. Blatter); Poona, Mahābleshwar (Butler).

This Rock-thrush appears to be a rare passage migrant in Salsette, our only records being the specimen and another noted on 23 February. On the adjoining Ghats, however, it appears to be commoner both as a passage migrant and as a regular winter visitant.

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The Blue Rock Thrush : *Monticola solitaria pandoo* (Sykes).

Field identification : Size between Myna and Bulbul. A uniform leaden blue bird with brown wings. Female duller and brownish. Seen solitary on boulders and about quarries, etc.

Specimen : *St. X. Col.* : 220 Andhēri January 1935 (H.A.).

Noted : *Bombay* : Warden Road, St. Xavier's College Compound, B.B. & C.I. Loco shed at Parel ; *Adjacent Mainland* : Karnala ; Alibāg.

A fairly common winter visitor to our area, usually found singly on rocky hillsides, and occasionally in the low country, from about the middle of October to April. S.A. records one as a frequent visitor to a bird-bath in the Collector's garden at Alibāg in March 1930. Aitken noticed it on rocks on the sea-shore. It has a habit of sitting bolt upright on the bridge of a roof, or cornice or some similar situation, and occasionally bowing and flirting its tail.

At Karnala it was observed eating the figs of a species of *Ficus*. It has also been observed making aerial sallies after insects in the manner of a flycatcher.

The Malabar Whistling Thrush : *Myophonus horsfieldii* Vigors.

Local Name : *Gogi* (Marathi).

Field identification : Size between Myna and House Crow. Deep blue-black plumage glistening in certain lights. Forehead and shoulders bright cobalt blue. Sexes alike. Singly or pairs on rocky hill streams.

No specimen collected.

Noted : Kaneri Caves, Shendur, Trombay Hill ; Apsoli (Alibāg) ; Pārsik.

Apparently much persecuted, both for its beautiful plumage, and for its young which have a ready demand as cage birds. A few pairs still manage to survive in the hills and jungle in the immediate vicinity of the Kaneri Caves, and in the northernmost parts of Salsette. We have also noted and heard it among the water-courses in the Trombay Hills during the rains. It is common among the hills across the creek, north of Salsette, and in the Ghats at Khandala and Panchgani. Its loud, rich, wandering whistle, startlingly human, has earned it the name of the Whistling School-boy. Others call it the 'Byculla loafer'. In the remoter hills, north of our area, round Wada and Suriamal, there is hardly a hill-stream that has not its pair of Whistling School-boys, and there is no doubt that if the general practice of taking the young of this bird were put a stop to, they would soon become more numerous in Salsette.

It is usually observed either singly or in pairs. Like other members of this and allied families it constantly jerks its tail and spreads it fanwise. It has been suggested that this habit has developed among birds inhabiting wet and slippery rocks, to help them in maintaining their balance on precarious footholds. Having observed this apparently superfluous movement of the tail (or wing) in widely differing forms, we are inclined to suggest that its true purpose is to dislodge lurking insects. The School-boy has also been noticed swallowing entire drupes of *Jasminum malabaricum* from a shrub over-hanging a rocky nullah. A stone was seen to be disgorged later.

Breeding : The Whistling Thrush breeds at the Kaneri Caves, where H. A. has found several old nests and seen them building on 30 June 1935. Across the harbour, he has found a disused nest at Apsoli. At Khandala and Panchgani they breed commonly from early June to late September. The nest is a large cup-shaped structure of mud, held together with rootlets and moss. There is also usually a slight lining of moss. It is most often placed in a niche in a rock either by the side of or overhanging a running hill-stream, the rock to which the nest is attached being often wet with spray. A favourite site at Khandala is inside the numerous tunnels through which the pipe-lines run. The nest is then in entire darkness. The same nest is built upon year after year, growing in size until considerable dimensions are achieved. At Panchgani, S.A. discovered several nests down wells. The period of incubation is 16 days. The usual clutch is of 4 eggs.

The Red-breasted Flycatcher : *Siphia parva* subsp.

Field identification : Smaller than a Sparrow. A plain brown fly-catcher with a black and white tail. The tail is often jerked up or held robin-wise with wings drooping on either side. The sexes are alike but in summer the throat and breast of the male become orange-chestnut. Seen singly in mango orchards, etc.

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Specimens: *B.N.H.S.*: ♂ 15-1-24 Andhēri (S.H.P.); ♂ 16-2-24 Pāli Hill (S.A.).

Noted: Bandra, Chembūr, Thāna.

This pretty bird appears to be a scarce but regular winter visitor to the mango orchards and such other shady places in our district. It makes short sallies after insects, and sometimes also hovêrs before a flower or sprig in search of them. Occasionally one may hop on to the ground from an over-hanging perch, and with a couple of jerks of its cocked tail, snap up an insect near the ground and flit back to its perch. It is in regular attendance at the flowers of *Bombax malabaricum*, for the insects that crowd to the nectar.

Tickell's Blue Flycatcher: *Muscicapula tickelliæ tickelliæ* (Blyth).

Field identification: Somewhat smaller than the Sparrow. 'A dark blue bird with the throat and breast reddish and the rest of the lower parts white. No white line over the eye' (*Whistler*). The female is duller all round. Usually singly, in scrub and secondly jungle.

Specimens: *B.N.H.S.*: ♂ 7-6-25 Trombay Hill (S.A.); ♂ 16-1-24 Andhēri (S.H.P.) *St. X. Col.*: 19 Powāi 17-11-32 (H.A.).

Noted: Malabār Hill, Chembūr, Gōdhbunder, Andhēri, Kihim, Karnala, etc.

This cheery little bird is common in the better wooded and forested parts of the island from October to May. While it is certain that some at least remain in our area during the monsoon, it is obvious that the majority go away to breed. We have no record of a nest in our area; the nearest is from Poona where Betham took nests in August (*J.B.N.H.S.*, xii, 78).

The Verditer Flycatcher: *Eumyias thalassina thalassina* (Swainson).

Field identification: Size of a Sparrow. Male bluish-green, female duller.

Specimens: The British Museum has the following specimens:

2 ♂♂ 1-11-75 Matheran (Hume Coll.); ♀ 4-2-72 Matheran (Capt. Lloyd): ♂ 15-2-18 Khandala (Gosse).

There is one in the St. X. Col. Collection obtained at Khandala in November.

Noted: Karnala; Shendur (Salsette); Kihim.

This is probably a regular winter visitor or passage migrant to the more remote and secluded valleys in our island. At Shendur, on 3-1-35, several birds were seen, and at Karnala on 16-2-36 it was quite common in a forest association comprised of *Hypothymis, Tchitrea, Ægithina,* various *Phylloscopi,* and *Chaptia*. Like all the smaller flycatchers, it has the habit of sitting bolt upright and remaining in that position for some time.

The Indian Brown Flycatcher: *Alseonax latirostris* (Raffles).

Field identification: Somewhat smaller than Sparrow. Similar in appearance to female of Red-breasted Flycatcher, but distinguishable from it by absence of white in tail feathers. Solitary, in wooded country.

Specimens: *St. Xavier's College*: 140, 142 Kihim 23-10-33; 188 Bombay 23-3-34.

Noted: Andhēri, Marōl, Borivli, Trombay Hills, etc.

Common on passage during October and again in March. A few are winter visitors. It frequents gardens and mango groves and open deciduous forest. In habits it is very like the last species.

The Paradise Flycatcher: *Tchitrea paradisi paradisi* (L.)

Field identification: Size about that of a Bulbul. The adult male snow white with 2 long ribbons in tail and metallic black head. Female and young male chestnut brown above, without tail ribbons, with black head and greyish-white underparts. Singly or pairs in gardens and light deciduous forest.

Specimens: *B.N.H.S.* ♂ 1-2-26 Malād (E. Henricks); ♂♀ 27-1-29 Chembūr; ♂ 3-3-29 Tūlsi Lake (S.A.); *St. X. Col.* 181 Powāi 9-3-33.

Noted: Andhēri, Khandala, Kihim, Kankēshwar, Panchgani, Gōdhbunder.

A common winter visitor from about the middle of October to early May. Some also on passage. This delightful bird is a frequenter of shady groves and gardens and over-grown nullahs, and is also met with in all the well-wooded parts of Salsette, though nowhere in great numbers. Its graceful and agile movements—especially those of an adult male, with its ribbons trailing in the air as it makes the usual flycatcher sallies after insects—are particularly

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fascinating to watch. In spite of the striking colours of the adult male it is remarkable how inconspicuous the bird can become when sitting motionless with the sunlight falling in patches through the foliage.

Breeding: We have no record of its breeding in our area though it may possibly do so in the Ghats about Khandala.

The Black-naped Blue Flycatcher: *Hypothymis azurea styani* (Hartlaub).

Field identification: Size about that of a Sparrow. Male, a brilliant blue with whitish underparts. A black patch on hind crown and a black crescent on throat. Female browner with a dull bluish wash confined to head and neck. Flits about among foliage of trees in forest, and often erects and opens tail fanwise.

Specimens: *B.N.H.S.* ♀ 28-11-27 Mulund (S.A.); ♂ Malabār Hill (P. M. D. Sanderson); *St. X. Coll.* 141 Kihim 21-10-33 (H.A.).

Noted: Chembūr, Andhēri, Borivli, Gōdhbunder, Pawāi Lake, Tungar Hill, Karnala, Rōha.

Common in the cold weather; and a few remain behind to breed. This bird inhabits the same type of country as the Paradise Flycatcher and where one is found the other may be confidently looked for. Its voice and notes when flitting about or launching sallies after insects bear a close resemblance to some of those uttered by *Leptocoma asiatica* and *Æthopyga vigorsi*, a sort of harsh interrogative 'chi-whi?'

Breeding: On 8-5-35 a pair was discovered building in the tiny fork of a mango 30 feet from the ground in a garden at Kihim. The nest was, however, deserted owing no doubt to the unwelcome attention of crows. Br. Navarro took a c/3 at Khandala in June.

The White-spotted Fantail Flycatcher: *Leucocirca pectoralis pectoralis* Jerdon.

Local name: *Nāchan*.

Field identification: Size about that of a Sparrow. Active sprightly blackish brown bird, spotted white about the breast and with a white eyebrow. The tail is spread fanwise and held erect.

Specimens: *St. Xavier's College*: 182 Andhēri 30-3-34 (H.A.).

A pair or two of these Flycatchers will be found in every garden both in the city and the suburbs. Even in the lesser inhabited parts of the island it occurs wherever there are shady open glades such as mango topes. They feed largely on the little Jassid hoppers that are so abundant on the bark of mango trees.

Within the forest itself it is less common than *Muscicapula tickelliæ* or *Hypothymis*. It is occasionally met with in mangroves by creeks etc.

Breeding: The nesting season lasts from March to August. Nests may be found wherever the birds occur: in gardens in the suburbs as well as those in the heart of the city. Lime and chikoo trees are especially favoured as nesting sites. The nest is a neat cup of fibres about 2 inches across, plastered over with cobwebs. It is very similar to an Iora's in appearance, but whereas the Iora's is rounded off at the bottom the Flycatcher's invariably has a bunch of strips hanging untidily underneath. It is usually placed 5 to 10 feet above the ground. The eggs almost invariably number three. The owners are bold in defence of their nests and furiously attack crows and other birds, even cats and human beings, intruding into their proximity.

In spite of this, however, the mortality in eggs and young is enormous, Crows, Crow-pheasants and Bloodsucker lizards being mainly responsible.

The Bay-backed Shrike: *Lanius vittatus* Valenciennes.

Field identification: Size about that of a Bulbul. 'Common in cultivation; a small bird with a longish tail, broad grey and white head with heavy black marking, maroon back and black and white tail, the markings sharply defined and conspicuous; perches in exposed situations.' (*Whistler*).

Specimens: *St. X. College*: 113 Jūhū 10-10-33; 153 Jūhū 27-10-33 (H.A.).

Though common in the Deccan the Bay-backed Shrike only straggles into the Konkan from October to March. We have only observed it amongst the Babool trees on the islands in the mud-flats and in the open fallow country at Kihim.

Breeding: It is known to breed at Khandala (*N. & E.*, i, 314).

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Photos

The White-spotted Fantail Flycatcher
(*Leucocirca pectoralis*).

Sálim Ali

Nest of White-spotted Fantail Flycatcher
with chicks about 10 days old.

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The Rufous-backed Shrike : *Lanius schach erythronotus* Vigors.

Local name : *Potia.*

Field identification : Larger than the Bulbul with a longer graduated tail. Head grey with thick black stripe through the eye. General colour grey with pale rufous-washed underparts, rufous rump and dark wings and tail. Singly, in open country.

Specimen : *B.N.H.S.* : Several from Pāli Hill, Santa Cruz, Andhēri, Kurla, etc. *St. X. College* 95 Borivli 28-9-33 (H.A.).

This bird arrives in considerable numbers regularly during the first week of September (one record 13 August, Kihim !) and stays till April (latest date 19th). When well 'in' this shrike is a prominent feature on the suburban countryside. It is particularly fond of country where scrub jungle, date palms and paddy cultivation abound. The neighbourhood of the Pawāi Lake, where a large portion of Bombay's toddy supply comes from, is specially favoured. It takes up its position on a date leaf or some other exposed situation and utters harsh 'screams' as if in distress, somewhat after the style of the Myna's alarm calls. At times it also produces a rambling song not unlike a Dhyal's, but the notes are on the whole harsher, the volume less, and it is altogether more prolonged. It is a clever and convincing mimic and imitates the calls of a large number of species to perfection. While with us these Shrikes are mostly seen as solitary birds each appearing to establish its own feeding territory or sphere of influence. From its coign of vantage it pounces upon any grass-hopper, lizard and the like that happens to show itself on the ground. We have seen one catch an earthworm and impale it on a karonda thorn.

Breeding : Br. Navarro took c/2 at Khandala in April (of this race or *caniceps?*).

The Pale Brown Shrike : *Lanius isabellinus* Hempr. & Ehrenb.

Specimens : *B.N.H.S.* : ♀ 14-12-99 Esplanade, Bombay (J. M. Mason) ; *St. X. College* 225 ♂ 13-2-35 Andhēri (H.A.).

The occurrence of this bird in our area is exceptional. It was shot in *Euphorbia* and Babool scrub bordering the mud-flats at Andhēri. Only one previous record exists from the famine year of 1899 when a large number of unusual species were driven south by the drought.

The Common Wood-Shrike : *Tephrodornis pondicerianus pondicerianus* (Gmelin).

Field identification : Size of a Bulbul. 'A grey bird with a pale eye-brow and a dark band through the eye, and white outer feathers in the tail' (*Whistler*). In trees in lightly wooded country.

Specimens : *B.N.H.S.* : From Vihar Lake, Trombay Hills, Pāli Hill, Andhēri, Kandivli etc., *St. X. College* 217 Vihār 29-12-24 (H.A.).

Noted : Pāli Hill, Santa Cruz, Kandivli, Trombay Hill, Kihim.

Resident. It affects lightly wooded country specially teak and other deciduous forest, and parties of 4 or 5 birds often follow one another from tree to tree. The birds creep about the branches like Ioras and snap up insects like flycatchers. They occasionally venture into gardens in the suburbs. They have several pleasant whistling notes 'wheet-wheet' followed by a quick interrogative 'whi-whi-whi-whi'?

Breeding : H.A. took a nest with 3 fresh eggs on 21 April. The nest was a small cup of fibres plastered over with cobwebs placed in a horizontal fork of a *Bombax* branch near the tip. The nest matches its surroundings beautifully and would be difficult to locate but for the movements of the owners. Br. Navarro took a c/3 at Khandala in May.

The Orange Minivet : *Pericrocotus flammeus* (Forster).

Field identification : A brightly coloured bird like the next, but slightly larger.

Specimen : *St. X. College* 215 Hills north of Borivli 30-12-34 (H.A.).

The specimen is the only record we have from Salsette. Another was seen at Tungar near Bassein on 2-4-34, and it appears to be commoner in the hills northward on the mainland.

Breeding : On 7-6-37 Br. Navarro took c/2 at Khandala. On 27-6-37 a female was observed collecting lichens off a tall tree in forest about 20 miles north of Bhiwandi along the Wada road.

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The Little Minivet: *Pericrocotus peregrinus peregrinus* Linn.

Field identification: Slightly smaller and slenderer than a Sparrow, with a longish tail. Male with blackish-grey head and breast, grey back, orange crimson underparts and the same colour in wings and at base of tail above. In the female the red portions of the male are yellowish and she is duller coloured on the whole. Flocks flitting about in trees in gardens and light forest.

Specimens: *B.N.H.S.*: From Bombay City, Andhēri, Trombay, Malad etc. *St. X. College* 27 ♂, 28 ♀ 6-8-33 Marōl (H.A.).

Noted: Andhēri, Malād, Pāli Hill, Chembūr, Bombay, Kihim.

Resident and fairly common throughout our area. Parties of from 4 to 8 birds may be seen following one another from tree-top to tree-top, keeping up a low musical cheep. In the cold weather flocks composed entirely of males may be seen. It is partial to mango orchards and well-wooded gardens. Parties may usually be seen on the Silk cotton tree in flower in company with birds of many species.

Breeding: The pair shot on 6 August were evidently nesting. The testes of the male measured 6×4 mm. and the oviduct of the female was greatly distended indicating that she had laid. On 4-6-34 a female was observed feeding a full-fledged young out of nest.

The Black-headed Cuckoo-Shrike: *Lalage sykesi* Strickland.

Field identification: Size Bulbul. Male ashy-grey with blackish wings and tail and black head. Female has the head grey and the underparts barred black and white. Singly or pairs in mango orchards and wooded country.

Specimens: *B.N.H.S.*: From Chembūr, Andhēri, Tūlsi Lake. *St. X. College* 218 24-1-35.

Noted: Andhēri, Tūlsi Lake, Kihim, Chembūr, Gōrēgāon (in mangroves) Borivli, Khandala, Panchgani.

Resident, and not uncommon. Though never seen within city limits this Cuckoo-Shrike may be met with in the suburbs almost everywhere. It frequents deciduous forest and mango orchards. The 'Lake District' is specially favoured and here it is partial to young date scrub. It goes about singly or in pairs. The male has a pretty, clear whistle consisting of several notes and ending in a quick-repeated 'pit-pit-pit' which we have only heard in the hot weather and the rains.

The stomach of a specimen contained remains of insects and their eggs and a large green caterpillar.

Breeding: EHA took a nest with 3 eggs 'not far from Bombay' in June. Barnes (*J.B.N.H.S.*, iv, 90) found it breeding at Vāsind on the mainland in July.

The Large Cuckoo Shrike: *Graucalus javensis macei* (Lesson).

Field identification: Size somewhat smaller and slenderer than a Pigeon. A grey bird with a broad dark eyestreak. Whitish underneath. Quills and tail black. Eyestreak in female less conspicuous and lower plumage barred grey and white. Singly or pairs in trees in wooded country.

Specimen: *B.N.H.S.* 14-3-26 Gōdhbunder-(S.A.).

Noted: Chembūr, Marōl, Jūhū, Borivli, Panvel, Kihim, Karnala, Tungar.

EHA states in his *Common Birds of Bombay* that it is common, but we have found it decidedly uncommon and nowhere plentiful except at Tungar near Bassein. It frequents well-wooded country such as that about Gōdhbunder and the lakes, usually moving about in pairs which continually call to each other in a peculiar musical scream.

Breeding: No records from our neighbourhood are available and we are not certain about the status of this bird in Salsette though apparently it is a resident.

The Ashy Swallow-Shrike: *Artamus fuscus* Vieillot.

Field identification: Size about Bulbul. Squatter and with shorter tail. Very swallow-like on the wing, but heavier. General colour dull-grey with a pale patch on rump. Bill heavy and somewhat sparrow-like. In open country with palmyra palms.

Specimens: *B.N.H.S.*: ♂♀ 17-11-27 Chembūr (S.A.); *St. X. College*: 71 Gōrēgāon 8-9-33 (H.A).

The Ashy Swallow-Shrike is common in the palmyra country in Salsette.

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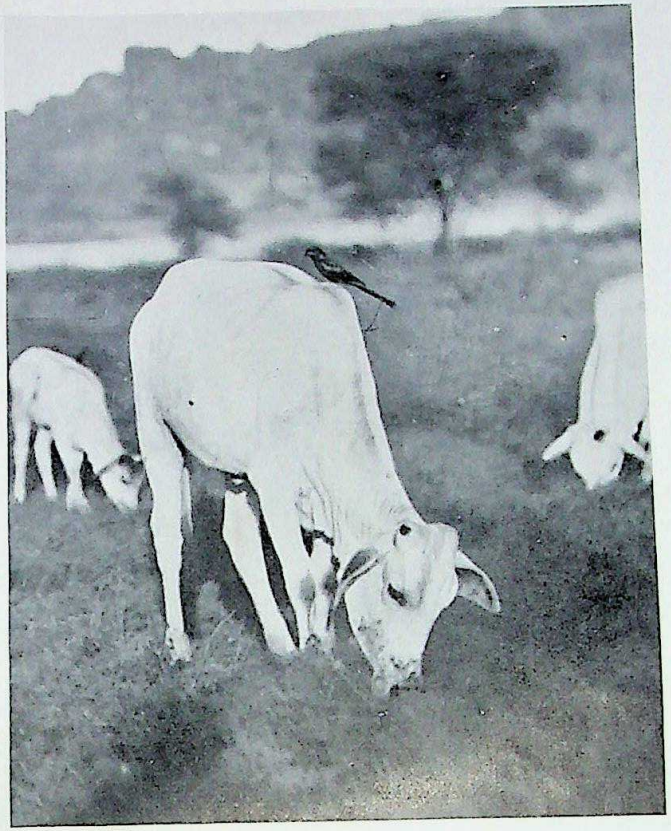
Photos

The Ashy Wren-Warbler (*Prinia socialis*)
on Coral Flowers.



Sálim Ali

The Black Drongo (*Dicrurus macrocercus*)
attending on grazing cattle.

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As many as 30 birds may be seen huddled together on a single palm leaf or on a telegraph wire. They roost at night in the same manner on palmyra palms. They may often be seen hawking together in loosely scattered parties with their heads to the wind like many birds that find their food in the same way, e.g. terns, swallows and swifts. They also make sallies from a perch to which they return after circling round like bee-eaters. Another method is to swoop down like a Kestrel on some insect on the ground and bear it away in their bill.

The food consists of insects. Butterflies are largely taken. One bird had swallowed a large Pentatomid bug.

Breeding: The nesting of this species seems inseparable from the palmyra palm (*Borassus*). The season is from the middle of March to June. The nest is a rough platform of palmyra fibres placed at the base of the leaf. The usual clutch appears to be of 3 eggs. Like King-crows they are pugnacious when nesting and will attack birds much larger than themselves.

Barnes found them breeding in palmyra palms on Elephanta Island in May. Swallow-shrikes seem to undertake sudden migrations of a few miles, disappearing from favourite localities and reappearing after some time.

The King-Crow or Black Drongo: *Dicrurus macrocercus peninsularis* Ticehurst.

Local name: *Ghosia.*

Field identification: Size about Bulbul. Glossy jet black with long forked tail. Familiar species present everywhere by cultivation and grazing cattle.

Specimens: *St. X. College*: 33 Marōl 6-8-33; 104 Andhēri 4-10-33; Andhēri 6-12-34; 213 Vehār 29-11-34 (H.A.).

Noted: Bandra, Māhim, Chembūr, etc. etc.

This is one of the commonest birds of the low country, and in fact is met with wherever the trees are not too close together to hinder its style of attack. Telegraph wires along a railway are favourite resorts, and if a census of birds were taken from a railway carriage the king-crow would easily top the list.

King-Crows have no connection with crows, except that they are their inveterate enemies during the breeding season. The crow has only to approach the neighbourhood of a drongo's nest to be mobbed. He is set upon and buffeted by the owners, whose superior agility enables them to dig beakfuls of feathers out of the intruder's back. This is we believe the only bird that scores over the crow in open warfare. And the crow knows it and holds the drongo in respect.

Drongos ride on the backs of cattle and buffaloes as they graze, and pick off the insects disturbed by the animals' feet. The cattle egrets stalk alongside to the same purpose. Fires, again, drive out insects from their hiding places, and you have but to fire a patch of grass or scrub to bring the drongos of the neighbourhood scurrying to it.

At Karnala an individual was seen busily hawking the large rock-bee (*Apis dorsata*) which were present in large numbers.

Drongos carry their food as well as their nesting material in their beaks, but a luckless grass-hopper that escaped from the bill was seen to be promptly re-captured in the claws.

Breeding: The duets which are a sure indication of the approach of the breeding season, begin in February, and the courtship is a prolonged affair. We have not seen eggs laid before May and June. The nest is usually placed at some distance from the ground, 15 to 30 feet as a rule. The tree chosen is often thorny like *Erythrina, Bombax* or *Bridelia retusa*. Mango and Neem trees are also patronised. The nest, a loose cup of fibres and fine twigs, is half-slung, half-wedged into a horizontal fork, often near the extreme tip of a branch.

The eggs, often visible through the flimsy bottom, are usually three in number, though we have seen nests with 4 and 2 eggs. The same site or tree is used in successive years.

The birds are bold and aggressive in defence of their nest, and make determined onslaughts on would-be egg-collectors. Large birds and mammals in the vicinity are constantly chivvied. The alarm note is long-drawn 'phiu-phiu'.

The Indian Grey Drongo: *Dicrurus longicaudatus* (Jerdon).

Field identification: Size and appearance as above, but slimmer and with the underparts duller and distinctive. Keeps to wooded country and hills in Salsette and not seen near open cultivation.

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Specimens: *B.N.H.S.* 4-12-34 Marōl (C. McC.) and others. *St. Xavier's College*: 200, 209 Bassein, December '34; 212 Vehār 29-11-34 (H.A.).

We had not suspected the occurrence of this bird in our area until one was accidentally obtained in mistake for the black drongo. Since then, however, we have seen numerous examples and the records go to show that it must be a fairly regular winter visitor to Salsette, especially in December and January. The earliest record is a specimen in the Society's collection obtained by E. Henricks at Bandra on 22-10-28.

The habits are similar to those of the previous species except that it does not appear to venture out usually into open country and cultivation and is more confined to the well-wooded portions of the island.

The White-bellied Drongo: *Dicrurus caerulescens* (Linn.).

Field identification: Size and appearance as of the black Drongo, but glossy indigo in colour instead of black, with the belly and under tail white.

Specimens: *B.N.H.S.* ♂ 11-12-99 Kalyan (J. Brand); 171-27 Bhāndūp (McCann).

Noted: Tūlsi Lake Environs, Kihim and Parōl Pāra (Alibāg Talūka).

Resident, but rare, in the hills of North Salsette. It is confined to well-wooded country. It is a noisy bird and our impression is that its notes are more musical than those of the Black Drongo. It is an accomplished mimic besides. We have, among other species, heard it imitate the Iora and the Tailor Bird to perfection. In the case of the former, not only were the whistles reproduced, but also the occasional 'chr-r-r' with which these are punctuated.

We have not found it breeding within our area or its immediate neighbourhood, though it doubtless does so.

The Bronzed Drongo: *Chaptia aenea malayensis* Blyth.

The *Fauna* gives the distribution of this Drongo as 'The whole of Western India, from South Travancore to Bombay'. Butler records it as far north as Khandala. One of us (H.A.) has observed it at Tungar near Bassein (on the mainland); on 16-2-36 a specimen was shot under Funnel Hill, Panvel (Kolāba District) in heavy forest where it appeared to be fairly common.

The Racket-tailed Drongo: *Dissemurus paradiseus malabaricus* (Latham).

Field identification: Size about that of a Myna, glossy black with a long tail. The bare shafts of the two outermost tail feathers are prolonged for about 12 inches beyond the tail proper and end in 'rackets'. A well-developed crest from forehead lying backwards over the crown. Sexes alike. Singly or scattered pairs and parties in forest.

Specimens: *B.N.H.S.*: ♂ 22-1-24 Andhēri (S. H. Prater); ♂ 20-10-28 Thāna Hills (McCann). *St. Xavier's College*: 40 23-7-33 Kaneri; 60 3-9-33 Jogēshwari (H.A.).

Noted: Powāi, Vehār, Tūlsi, Gōdhbunder, Borivli Hills; several places in the Kolāba District.

Resident and common in the better wooded portions of Salsette. It has a large repertoire of loud metallic notes and it is an excellent mimic besides. We have heard it reproduce to perfection the calls of the Shikra and of *Spilornis cheela*.

Breeding: We have observed a bird building in Salsette on 3 May and have records of nests and eggs on 17 and 30 June, 2 July and 18 August. On the last date full-fledged young were noted being fed out of nest. The best time for eggs seems to be June and July. The nest is a fairly deep cup of rootlets and palm fibres with little cobwebbing on the outside and without extra lining, placed in the fork of a branch or at the base of the leaf stalks of a palmyra palm, between 30 and 50 feet up. Two or three is the number of eggs we have usually found.

(*To be continued*).

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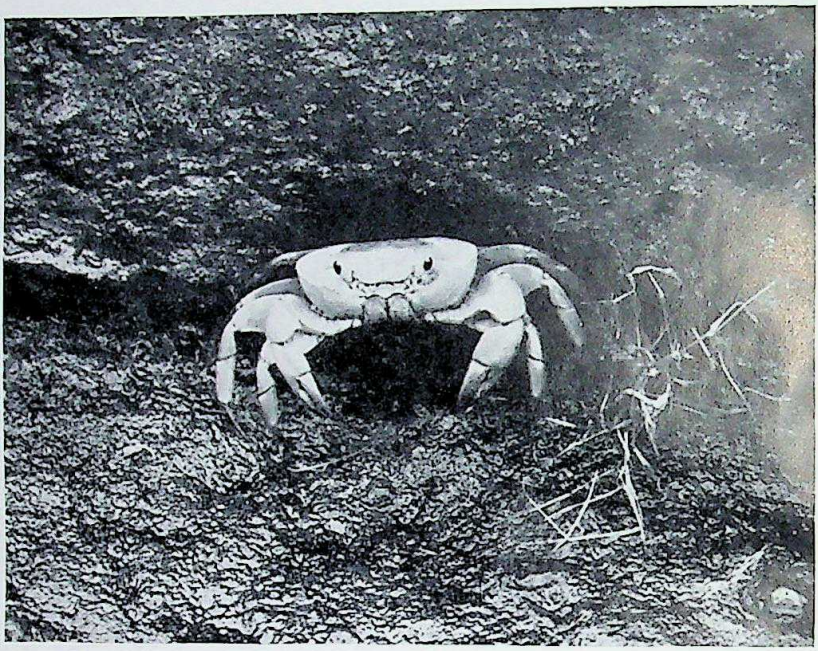

A female of the common Land Crab. [*Paratelphusa* (*B.*) *guerini* (M.—Eds.)]

Castles of the common Land Crab. [*P.* (*B.*) *guerini* (M.—Eds.)] alongside rocks.

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NOTES ON THE COMMON LAND CRAB *PARATELPHUSA* (*BARYTELPHUSA*) *GUERINI* (M.-Eds.) OF SALSETTE ISLAND.

BY

CHARLES MCCANN, F.L.S.

(*With two plates*).

At the Second Entomological Meeting held at Pusa in 1917 Mr. Bainbrigge Fletcher, Director of the Entomological Research Institute, Pusa, referring to the destruction of paddy crops by land crabs, remarked: 'Crabs have come into notoriety lately, especially in Madras, as paddy pests. In Bihar we have only had one report of crabs attacking paddy, but about five or six years ago we had a report from Karachi of damage by crabs in fields of young paddy. Recently they have come into prominence in Madras and Burma and there seems to be no doubt that crabs do some damage to rice plants.'

The Island of Salsette is infested with land crabs; but no utilitarian motive prompted me to investigate their habits. What really roused my curiosity was the appalling number of dead crabs lying about the fields and byways, in season and out of season. I wished to determine the probable cause of their death. But, as is usually the case in such enquiries, one point led to another and the net result was a collection of interesting notes which had little to do with the death-causing factor among crabs.

In this paper I deal with one single species, *Paratelphusa guerini*, and unless otherwise mentioned all my remarks are confined to it.

COLOUR.

Adult: At the time of their appearance, at the onset of the rains, these crabs display a wide range of colour. Some are a dirty white, others are purplish brown, and many are mottled with a mixture of both tints. Why this difference of colour? At first, I was under the impression it might be a sexual character, but an examination of several dozen soon dispelled this idea. The colour variation was common to both sexes. A second explanation suggested itself; that this colouring might possibly afford some particular advantage to the species, but a solution to this problem would have to be sought in its mode of life or its environment. The variation may or may not have some adaptive significance. Only observations in the field would suggest a solution to this interesting problem.

The crabs appear with the rains. Before the burst of the monsoon the ground is littered with dead leaves of almost every hue. Upon this variegated surface the crabs live. When disturbed

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they either run a short distance and stop, or remain perfectly still, alert and on the defensive, with the pincers outspread ready to nip. When on the move, the crabs where possible avoid open ground and scurry under the leaves. Anyone who has seen them in such environment cannot but conclude that the colouring, varied though it be, is protective. It is in perfect harmony with the variegated environment. The hues of the crabs blend remarkably with the colours of the fallen leaves among which they live and take shelter. This, I suggest, may be the explanation of the variation. [However, in open fields (agricultural land) the yellowish white 'type' appears to be predominant and at a distance may resemble a piece of quartz.) But with the weeks of rain the carpet of leaves loses its variegated colours; the leaves decompose and become black, and with the change of scene the purplish brown and mottled crabs 'disappear', leaving only the yellowish white ones. What became of the darker coloured crabs which were so common at the onset of the rains? Do they lose their richer tones and become yellowish? Are the darker ranges of colour but a temporary phase? This, I believe, is what happens. Purplish brown crabs which I kept in captivity lost their richer hues after a while and became pale yellow. There is presumably a definite bleaching process at work and this seems to me to be the only plausible explanation of the 'disappearance' of the crabs exhibiting the deeper ranges of colour. The yellow crabs are now fairly conspicuous objects against the dark humus of the ground or rocks. The protective colouring has been discarded. A factor which was till then apparently significant to the species in the struggle for existence is now no longer of importance. For, by the time the crabs have assumed this phase of colouring their existence is no longer essential to the continuance of the species. On emergence, the females, laden with young, are in need of protection but by the time their colouration has faded and all the crabs are uniformly yellow the young have been shed—they have accomplished their chief duty in life.

There is perhaps one serious objection to the theory of protective adaptation, namely, the colouration of the males, which as we shall observe later, have no need for such protection. However, the colouring may be due to some deep-seated physiological character which is common to both sexes and is beyond the scope of this paper. Nevertheless the colour protective adaptation is again supported by the colouring of the young.

Young: Young crabs, while still in the care of the mother are earthy brown in general tone with a slight tinge of flesh pink on the pincers. The carapace is really translucent and the brown colour is mainly due to the colouration of the internal organs showing through. As the young crabs are generally deposited in or find their way to flowing water, where they live and develop, the brown colouring makes it almost impossible to see them against earth. As growth proceeds, and this is fairly rapid, the crablings become lighter and lighter in colour eventually becoming yellowish white (some are pale reddish brown). This change from brown to yellow appears to be mainly due to the deposition of calcareous

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matter within the shell (exoskeleton). Accordingly the shell becomes more opaque and in old crabs is heavily calcified throughout—a sure sign of old age! The carapace of crabs of the season are usually semi-translucent and the contents of the crab frequently show through making that region darker than its surroundings. By the end of the rains, after several months, the adult stage is reached.

Breeding.

There appears to be little definite knowledge regarding the breeding habits of these crabs. In volume iv, p. 190 of the *Cambridge Natural History Series* dealing with the Crustacea and Arachnids, the author writes:—'The fresh-water crab *Thelphusa fluviatilis,* common in the South of Europe and on the North coast of Africa, belongs to the Cyclometopa, and is interesting from its direct mode of development without metamorphosis.' There is no doubt that we have the same direct development in *guerini* which belongs to a closely allied genus. The actual period at which mating takes place is still unknown.

On emergence the primary concern of the crab is the continuance of the species. However, as the females are laden with fully developed young, breeding evidently took place much earlier. When the crabs appear after the break of the rains, the females appear to be predominant in certain localities while in others there seem to be mostly males. The majority, if not all, the females are laden with young scarcely half a centimeter across the carapace. The number of young carried by each female seems to depend largely on her size. The young are held in a compact mass by the abdominal segments and the *pleopods*—metamorphosed swimmerets.

Disturb one of these females; she will either scuttle away to safety, dropping several of her young as she goes, or she will stand on the defensive. This 'premature' shedding of her young probably results from excitement on the part of the parent as she tightens her hold on the mass of young, thereby pressing some out. Generally the young remain with the mother for several days before she 'sheds' them or they leave on their own accord, when ready to fend for themselves. Nevertheless, crablings are quite capable of supporting themselves at a very early age.

As we have already observed, the adult females emerge from their burrows with their young fully developed. In all my wanderings I have never observed crabs in copula. The questions naturally arise, When do they copulate? and, When are the eggs deposited and hatched? The answers to these qustions are yet awaited. One thing is certain, and that is, that the eggs are laid and hatched when the crabs are underground.

According to Mr. Wagle (Dept. Agric. Bom., Bull. No. 118 of 1924, *Land Crabs as Agricultural Pests in Western India*, p. 20), the burrows are interconnected, 'If the openings of a burrow are further traced it is seen that most of them are connected superficially within a foot or two of the soil surface, though ramifications at a depth of four or five feet are not uncommon. A few only

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go deep down and each one of these burrows harbours a crab, probably the off-spring of the same mother liberated in the same burrow in connection with the mother burrow.' However, in none of his diagrams does Mr. Wagle indicate that there are any such interconnecting passages.' If the burrows are thus interconnected, the crabs are able to visit each other during the period of æstivation, so that it is really immaterial whether several crabs æstivate together in one chamber or alone in separate chambers—the sexes would have access to one another.

Considering the data we have before us, it is possible and even probable that copulation generally takes place within the burrows. Whether crabs are active within their burrows throughout the dry weather is yet another point which needs investigation.

Growth.

Crablings: As already indicated, the females emerge laden with young. The young are but miniatures of the adults. After a brief period of maternal care the young are 'shed' and have to fend for themselves. The country is teaming with them. The number of young produced by a single female appears to be dependent on her size, small females having fewer young than larger ones. The greatest number I have recorded from a single individual was 252—what a family! Each youngster at this stage measures a little over 5 mm. across the carapace. Should the young at this age fall away from the parent they frequently climb back into the mass and remain with her, if unable to do so, they are quite able to fend for themselves.

During the early period of their lives crablings spend far more time in water than do the adults, feeding on the bottom of small streams.

Moult: At the time of moult crabs usually secrete themselves under stones, in holes or remain submerged in water. I have repeatedly found crabs soon after they had moulted and once had the pleasure of seeing one 'walk out of its old self'. The carapace splits horizontally across the 'face' of the crab and opens like the lid of a box. The creature then gradually and laboriously draws itself out of its 'old skin' and then sinks down to rest till its coat of mail hardens once more. On emergence from the old shell the animal is generally perfectly white (sometimes tinged with pink), soft and defenceless. It is limp and unable to walk; it lies almost motionless till it has hardened again. If the crab be bruised at this period a milky exudation takes place. The hardening process is slow.

Senses.

Sight: Sight is well developed.

Smell: The sense of smell is apparently very keen. Experiments by way of drawing a piece of meat tied to a string through water which was then removed, clearly indicated that the crabs were able subsequently to follow the trail quite easily. Again meat juice dropped in the water immediately attracted the crabs. They

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would grope about with their pincers in the line taken by the flow of the juice.

Sounds: At first it might appear strange that a crab is able to produce any kind of sound at all. Nevertheless, it is capable of making quite an audible hissing noise on occasions. This is effected by rapidly 'blinking' the eyes in and out of their sockets. At first, when I heard this sound, I thought that my ears deceived me, but when I listened more closely and watched the animal I soon discovered how it was made. The lower margins of the eye sockets are provided with a fringe of stiff hairs. This undoubtedly forms a natural brush for cleaning the eye itself—an automatic cleaning apparatus! When this fringe is dry and the eye is rapidly moved across it, it produces a soft hissing sound. The sound I have noticed only when 'dry' crabs are freshly caught. Having once discovered this I paid a little more attention to it. It seems to be a habit of the crab to produce this sound when closely approached and when caught. This noise is apart from the usual bubbling noise made in the process of respiration.

Habits.

Burrows: The burrows are at first made large enough to admit the crab sideways and to allow of the free play of the pincers. As the crab grows it enlarges the burrow accordingly. The burrows are made either in the fields themselves or more often in the bunds, but the site of the burrow is dependent on the amount of water present. When the fields are flooded the crabs seek higher ground, such as the bunds, for if the burrows were continually under water the animals would be drowned. Towards the end of the rains, when the water level in the soil falls, the crabs return to the fields to make their holes and build their final castles. Away from paddy fields, they burrow into the banks of streams just above the usual water level. Final burrows are generally excavated in the bed of the streams. Unfortunately, lack of time and opportunity have prevented me from making a systematic study of the course of the burrows. According to Mr. Wagle (l.c.) the crabs dig down deeper and deeper as the level of the water falls. The course is irregular and the burrows are interconnected by side tunnels.

Life under ground: Towards the close of the rains the crabs are to be seen actively excavating burrows, collecting leaves, grasses and other food which is conveyed into the burrow. This they continue till the land surface is almost quite dry. When sufficient storage has been accomplished they retire till the break of the next monsoon. Once the dry period has set in all crabs retire irrespectively whether they are near perennial water or not, though crabs so favourably situated do go down a little later. Within the burrow now lies the secret of the crab's early life-history which still awaits solution.

'Castles': Crabs build small or large castles throughout the rains but the final castles, which are generally larger, are built when they are about to go below the surface. The time when building commences would vary with weather conditions and locality. The building of the castle is an effort to get rid of some

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of the earth within the burrow which is piled up at the entrance, but this is perhaps not the only reason. It possibly affords a certain amount of protection to the burrow by keeping off would-be intruders. Fallow fields and low lying land are favourite sites for the final burrow.

The walls of the castles are composed of pellets of mud brought up when still wet. The pellets are heaped up on each other and eventually form a compact mass. These pellets appear like excreted earth or a fine mixture of mud with some secretion. The castles are frequently conical in shape and may occasionally rise a foot or more above the surrounding ground, but they usually vary between 2 and 8 inches in height. When the castle is complete, the entrance of the burrow is plugged up from within and the crab enters on its long period of life under ground.

Why these castles are constructed is problematic. As already suggested it may be to keep off intruders. At the time when the crab is about to æstivate there are numerous other animals which are also looking for a suitable retreat. Some are unable to excavate their own burrow; others prefer to find a convenient ready made burrow rather than dig one, and find a crab hole convenient. If the entrance of the crab's burrow were flush with the ground the entrance with its fresh plug of mud would be easily accessible. But as the entrance is raised and the walls of the castle solid they act as a bluff which is mistaken for a clod of earth!

When the crabs first appear the females are a lot more cautious than the males and are less frequently seen in the open. When sufficient rain has fallen to make puddles and cause the streams to flow, the females laden with young congregate on the banks and in the water. During this period the females spend much time submerged on account of their young and it is also at this period that the young leave the parent. In such localities there is always a sufficiency of hiding. On the slightest alarm they hurry away.

During showers and under the cover of darkness the adults wander about much, but when the sky is cloudy or sunny they make for the water.

As the monsoon advances the adult crabs tend to decrease in numbers very rapidly and considerably. The younger generation now take their place. Where do the old crabs go or what happens to them? Do they die out or retire into their burrows once more? These are questions that started me off on these investigations. Some may volunteer the opinion that the crabs disappear in the vegetation. This I am not prepared to accept as young crabs are all about. That they do not retire to their burrow is certain for they would be drowned, as they are not able to stand submergence indefinitely. From personal experience, I am of the opinion that these crabs live but one year and that they die in the open during the monsoon or soon after.

When within the burrows, the chelae are generally carried adpressed to the body, but in case of attack the chela nearest to the intruder is placed at the entrance ready for action. Once a crab seizes an intruder it will not let go easily. This frequently

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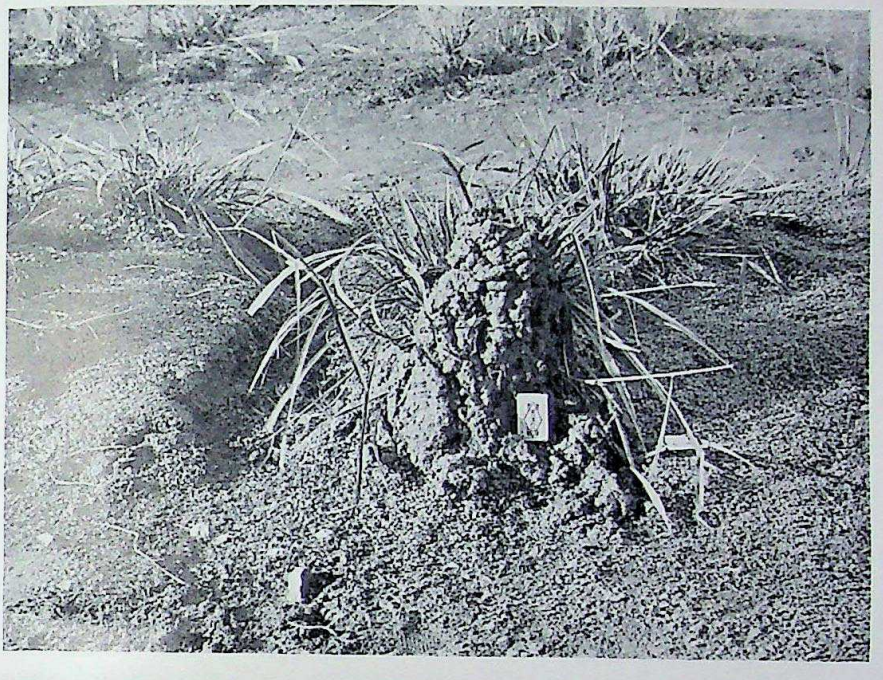
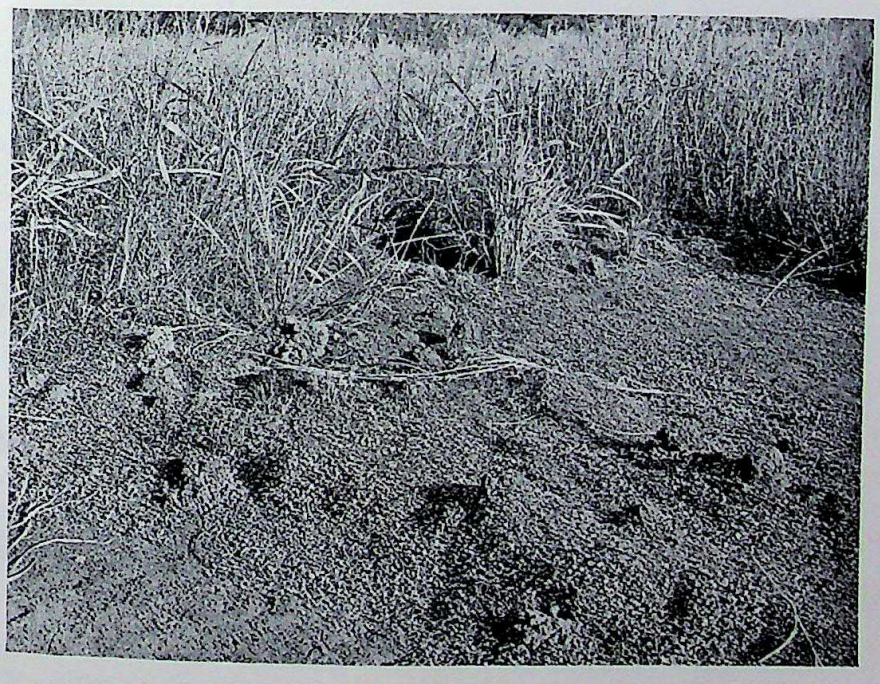


A castle of the common Land Crab. [*Paratelphusa* (*B.*) *guerini* (M.—Eds.)] in an unused field at the end of the rains. (*Match box for comparative size*).



Several castles of the common Land Crab. [*P.* (*B.*) *guerini* (M.—Eds.)] in a field at the close of the monsoon.

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leads to the loss of the chela or the capture of the crab. This habit is common to most crabs and is frequently made use as a ruse to capture them. People who catch crabs by this method tie a piece of meat to the end of a stick. The stick is thrust down the burrow. The crab in time seizes the bait and is gradually drawn out of its hole. The hole is then blocked with the free hand or foot and the crab is caught. Nevertheless this habit of the crab though it may frequently lead to its death at the hands of men is also a means of securing much of its animal food.

Whether these crabs are nocturnal or diurnal or both, is a difficult matter to decide. This would depend much on weather conditions. The crabs are about both day and night during the short period of their activity on the surface. When the weather is cloudy and rain is continuous they may be seen about at any time of the day or night. However, I am inclined to believe that they are more nocturnal as they appear to be much more numerous and active under the cover of darkness. At night they wander farther from their burrows. Apart from the fact that the crabs do not like direct sunlight which desiccates their gills, they probably find a certain amount of protection from their enemies at night.

Another point that needs consideration is that their period of activity is during the monsoon when the sky is overcast with dense clouds, so it is not surprising to find them about during the day. When the sun appears between showers and it gets really hot, the crabs retire to a goodly extent, if not into their burrows, into water or shade.

Though these crabs cannot remain submerged for many hours at a stretch, they are as well at home in water as on land; but they are not able to swim. They merely crawl along the bottom. During the monsoon, when the air is damp, they are able to remain on land for weeks without showing any ill effects. This indicates that they are well adapted to terrestrial life.

When the crab respires on land bubbles appear continuously at the mouth, but when in shallowy water, the mouth parts are lifted above the surface from time to time and then submerged; at the time a series of bubbles arise from near the base of the last pair of legs. This action is continuous.

These crabs do not appear to be pugnacious. They frequently live together in the same hole (during the rains) and inhabit the same pools feeding within close range of another. However, I have frequently observed a crab resent the entrance of a particular individual into its burrow whereas another went in unmolested. Whether this behaviour indicates a certain social grouping or whether it is just a submission of a weaker to a stronger one is hard to say. Occasionally there are fights but these contests take on more the form of sham-fights—there is much display of arms but actual damage is seldom done, as one of the combatants usually runs away. Young crabs, as is a common rule in Nature, have a certain amount of respect and fear for their elders. Whether these crabs are really cannibalistic, in so much as they kill and eat one another, is difficult to say; but, it is certain that they

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frequently eat their dead, picking the soft parts out of the shells. On the whole they appear quite peaceable among themselves. This is borne out by the fact that several may be kept in the same container, if not too crowded, without difficulty.

Generally the sexes may be distinguished by the fact that the males usually carry larger chelae of which one, either right or left, (though generally the left) is larger than the other. Another point which is worthy of note is that on dissection I found that the fat bodies in the females are bright yellowish orange whereas in the males they are dull and not yellow.

Food: Like most crabs, this land crab is omnivorous and it is an excellent scavenger and controller of injurious pests, as we shall notice when we review its menu. Little escapes its attentions. Fresh and decomposing vegetable and animal matter are all included in its diet. Leaves, algae, fruit, insects, amphibia, reptiles dead or alive, are all welcome. Much of the meat is caught at the entrance of the burrows and shelters. Unwary fish are caught as they swim by the submerged crabs. These food observations are not mere generalizations but are based on either experiment or experience in the field.

Once I saw a two-feet-long Checkered Water Snake (*Tropidonotus piscator*) wriggling violently with its head held fast under a stone as though it had been pinned. The behaviour was curious. I pulled at the tail of the snake to find it firmly held. On removal of the stone I discovered that a large crab had the head of the snake in its pincers! Probably the snake went under the stone for shelter or in quest of food, but the crab had forestalled it. When the stone was removed the snake struggled frantically with the crab still holding on. Eventually the crab lost its chela but it still remained affixed to the head of the snake. On another occasion I witnessed a crab dragging a much larger corpse of the same species of snake across an expanse of rock. The back had been partially eaten. I watched the proceedings till the snake disappeared into the crab's burrow. I have frequently witnessed crabs taking things home.

Earth-worms form a good portion of their diet. These they usually catch when abroad at night or when the worms come out during the day. I have frequently seen crabs catch living frogs, lizards, beetles, moths, grasshoppers and other insects. Carcases of any sort when near or in water are frequently covered with crabs.

If one watches a crab feed on wet rocks or at the bottom of a stream, it will be noticed that it is continually ferreting about for some invisible object which is conveyed to the mouth. The pincers are going to and fro from the rock to the mouth and *vice versa*. They appear to be groping for algae. Crabs are seldom guilty of a breach of etiquette—they never overfill the mouth! Particles of food are usually minute. The food is dissected by the pincers into minute bits before it is conveyed to the mouth; but one may occasionally see a crab hold up a large piece at its mouth and get its strong jaws into action.

If a crab had to rely entirely on its pincers for its food, those that have lost them would die of starvation. This thought puzzled

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me for a time, but a pincerless crab solved the problem for me by a practical demonstration. It lowered its mouth to a piece of meat and worked at it with its jaws. This of course was a rare occasion as crabs are usually very careful of their pincers. While on the subject of missing pincers, it might be mentioned that missing limbs are not replaced.

Enemies : Apart from man, these creatures have a wide circle of natural enemies : mammals, birds, reptiles and amphibians all take a fair toll. In addition to these animals which prey on crabs for food, there are parasites.

Mammals: among the mammals jackals, civets, mungooses and rats exercise a fair check. Otters live largely on crabs. (Though I strongly suspect the presence of otter in Salsette, I have never been able to confirm this. My suspicions are based on droppings.)

Birds: Birds take a heavy toll of young and old crabs. The Malabar Whistling Thrush (*Myophonus horsfieldii*) is perhaps the foremost. This bird catches the crabs, batters them against the rocks till the carapace is broken and feeds on the soft part, but young crabs are often swallowed whole. The White-breasted Kingfisher (*Halcyon smyrnensis*) is another in the vanguard. Crows, herons, egrets, kites and probably a host of other birds also feed on this crab.

Reptiles[1] : Among the reptiles, the Bloodsucker (*Calotes versicolor*) and Skinks (*Mabuia carinata*) are not averse to taking small crabs that they can overpower and conveniently swallow. So far I have no evidence of any snake eating a crab.

Amphibians : In the ranks of the amphibians are found the greatest enemies of the crabs. The bull-frog (*Rana tigrina*) and the common toad (*Bufo melanostictus*) account for a very large number of young of all sizes and the bull-frog will swallow almost full-grown specimens. The skipper (*R. cyanophlictis*) undoubtedly feeds on small crabs, but for this species I have no actual evidence.

The calcareous shells are not digested but are passed in fragments in the excreta.

Parasites: Crabs also suffer from several parasites, both internal and external. In Salsette I have found the leech (*Paraclipus vulnifera* Harding) a serious pest on this crab. It attacks the soft parts at the joints of the limbs and the gills and the lining of the gill chamber. The largest number removed from a single crab was 27, some were attached to the joints but the majority were in the gill chamber. In spite of the accumulation of leeches the crab did not appear to be greatly inconvenienced. Leeches infest the crabs mostly towards the end of the rains. The gill chambers seem to be the breeding ground and when the crab moves about in water the leeches, both young and old, come out of the chambers and wander about the carapace. I am of the opinion that the leeches also use the gill chambers during the dry season as a convenient harbour to tide over this period.

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[1] Since writing the article I caught a young *Varanus bengalensis* and found that its stomach contained almost exclusively young crabs.

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This particular species of leech has only once been reported from South India affecting another species of the same genus of crab, *P. hydrodromus*.

Rao Sahib Y. Ramachandra Rao, in 'A note on *Paratelphusa hydrodromus* Herbert, The Fresh-water Crab of South India' (Proc. 5th Ent. Meet., Pusa, 1923, p. 138) writes 'The bronchial chambers of these crabs are found to be infested by a species of leech. Leeches are generally suckers of blood and in this case they are very probably true parasites on the crab, attacking the membrane of the bronchial chamber and the gills and sucking the body juices. Generally three or four may be found in each crab, but in one case fourteen large leeches, besides two or three young ones were noted in a single crab. It is however doubtful if the leech, even if present in large numbers, will form any efficient check on the crab.'

Legend or Observation? In India there is a current belief that the jackal catches crabs by thrusting its tail down the burrow of the crab. The crab seizes the tail and is then pulled out of its hole and devoured. Curiously enough there is a very similar story told by Olaus Maginus, a Scandinavian Bishop, who lived in the sixteenth century, about the fox. This good church dignitary has been responsible for the most fantastic 'unnatural' history stories. He says: 'Sometimes fearing the multitude of wasps, he counterfeits and hides himself, his tail hanging out and when he sees that they are all busy, and entangled in his tail, he comes forth, and rubs them against a stone or tree and kills them and eats them. The same trick, almost, he useth, when he lyes in wait for crabs and small fish, running about the bank, and he lets down his tail into the water, they admire it, and run to it, and are taken in his fur and pulled out.'

Land Crabs and Agriculture: From an agricultural aspect land crabs in general (and the genus *Paratelphusa* in particular) are considered serious pests to paddy crops in certain districts. I have already quoted Mr. Fletcher's remarks in this connection. Mr. Ramakrishna Ayyar referring to the same subject in the Madras Presidency said:

> '. . . It has been observed that damage may be very serious in areas where single seedling transplantation of paddy is done. It appears that the crabs have been attacking paddy for several years but the damage was noticed before the practice of transplantation was to put in bunches of several seedlings.'

It is strange that single transplantation was still continued and the old method not adhered to when damage to single seedlings proved devastating! In Salsette, bunches of seedlings are transplanted, never single seedlings. Careful watching of the paddy fields has shown me conclusively that the damage to paddy crops is negligible in the island. The only period at which I have noticed *P. guerini* nipping leaf blades is before the transplanting of the seedlings. This is generally done by the crabs inhabiting the field of seedlings, but there is no invasion of the field. However the damage is not severe. After transplanting the damage is negligible. A little leaf-collecting is done when the animals are about

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to retire under ground. At the time when the crabs attack the paddy seedlings they also attack vegetable seedling along with other vegetation. During the rains the crabs move about freely among the fields without doing any 'serious' damage, they are more in quest of animal food.

Mr. Ghosh (Proc. 3rd Ent. Meet., Pusa, 1919, p. 680-87) published a note entitled 'A Note on Crabs as Pests of Rice'. There is an account of the crabs of Bengal which are said to attack paddy. As our species does not occur in Bengal this paper does not concern us directly, but is nevertheless interesting. The arguments brought forward convicting crabs of damage to paddy are not convincing and the damage, taken as a whole, appears negligible. Experiments conducted in metal cylinders likewise do not prove any definite point against the crabs. In fact, referring to the north of the river Gandaki, Barail, Mr. Ghosh (l.c., p. 685) observes:

> 'On the south side there are large rice growing tracts in which no damage by crabs is reported, though crabs are common at a distance of only about two miles from the fields on the opposite side of the river. These fields do not allow water to accumulate in the way the Barail fields do.'

This appears to indicate that the rivers may form a natural barrier to land crabs. Finally Mr. Ghosh observes:

> 'In the writer's experience crabs have not been observed to cause damage on any scale although plants have been observed to be cut and the crop thinned in patches. It could not be made out why plants were cut in this manner. They certainly did not afford food to the crabs. If the crabs had eaten the plants or had been obliged to cut them in order to get their food, it was clear from the enormously large number present in the Barail fields that severe damage would have resulted and probably the rice growing would have been impossible there.'

Further (I.c., p. 687) the same author writes:

> 'In North Bihar crabs cannot be considered a pest of rice in the strict sense of the term.'

Reviewing the literature at my disposal, the only *real damage* crabs are responsible for is: the riddling of the bunds between adjacent fields with their burrows, thereby weakening the bunds, and in time causing them to collapse, letting the water out of the fields. Mr. Shroff (Proc. 2nd Ent. Meet., Pusa, 1917, p. 156) writes, 'These crabs burrow into the *Kazins* (*bunds*) and allow water to percolate through, thus causing paddy fields to dry up in some places.' After much watching, I have arrived at this conclusion also, in Salsette Island. The actual destruction of plants is *very negligible*. If crabs were in the habit of destroying paddy crops, Mr. Ghosh rightly remarks that *paddy growing would be impossible*. This would be the case in Salsette, as the island is infested with crabs.

Preventive measures: The suggestion of preventive measures against crabs seems, therefore, rather premature.

Economics: *Paratelphusa guerini*, as far as I am aware, is of no economic value. In Salsette it is not used as food or for any other purpose by the local people.

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Medicinal value: 'According to the Ayurvedic system of treatment, crabs are wholesome diet for patients having pulmonary complaints including consumption.' Ghosh (Proc. 3rd Ent. Meet., Pusa, vol. ii, p. 685).

Advantages of crabs: Land crabs have rightly or wrongly come in for a good deal of abuse; but I am firmly convinced that the abuse is on the whole unjustifiable, particularly in the case of *Paratelphusa guerini*. In accordance with the time honoured saying, 'There is bad in the best of us and good in the worst of us' there is also some good to be found in crabs. Let us now strike a balance sheet.

As already observed, they are excellent scavengers, removing much decomposing material from the surface. Like earth-worms, they are responsible for much turning over and aerating of the soil. Perhaps their most important use is to be found in the value of their exoskeletons. Their shells supply the land with a large amount of calcareous material, very necessary in lands used for the cultivation of paddy. The last but by no means the least point in favour of crabs, is that they catch a lot of insects many of which are injurious to paddy.

Considering these good qualities of the crab and that the case of *serious damage to paddy* has not been conclusively proved against them, are we justified in exterminating them? The balance is in favour of the crab, therefore let us look on them in a more kindly light. Their destruction without actual and sound reasons may result in more serious injury to the paddy crops.

Species of land crabs in Salsette:

(1) [1]*Paratelphusa* (*Barytelphusa*) *guerini* M.-Eds.

This is the commonest crab in the fields and hills of Salsette.

(2) *Paratelphusa* (*Barytelphusa*) *jacquemontii* (Rathbun).

This is the largest of the land crabs in the area. In general colour it is reddish brown or purplish. It generally inhabits the beds of streams, living among the boulders and rocks. It is far more aquatic than *guerini*. It is occasionally found in fields. In habit it appears to be somewhat more nocturnal than *guerini*. This species is much sought after by the local people as an article of diet and is sold in the bazaar.

3. *Paratelphusa* (*Barytelphusa*) *mccanni* Chopra and Das.

Four were discovered among the specimens I sent to the Indian Museum for identification. It is much like *P. guerini*.

4. *Gecarcinucus* (*Gecarcinucus*) *jacquemontii* M.-Eds.

This species is distinguished from *P. guerini* by its more convex shell and closer set, small eyes. The shape of the pincers is also distinctive. It may occasionally be found in fields but is to be considered rare. In several seasons I have only found four or five and these appear to be very local.

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[1] I am much indebted to Dr. B. N. Chopra for kindly going through and identifying the material and also for naming the new species after me.

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Common Indian Nightjar (*Caprimulgus macrourus*).

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NOTES ON SOME INDIAN BIRDS.

BY

E. H. N. LOWTHER, M.B.O.U., F.Z.S.

II.—NIGHTJARS.

(*With five plates*).

Those who have never seen a Nightjar at rest but only know it as a long-winged bird with an erratic flight shown up sometimes by the headlights of a car have no conception of the sombre beauty of its plumage. Their livery is a symphony of quiet browns and greys, each feather exquisitely pencilled with black, white or buff markings. Nightjars unfortunately only come to life, so to speak, at dusk. This alone makes it sufficiently difficult to study the bird in the field. Accurate observation in India is however, made harder still owing to the occurrence of several species of nightjars, all of them much alike in colouring so that even the expert has difficulty in identifying them correctly. No wonder then that until recently, comparatively little was known of the habits, status or even calls of the genus as a whole. My own knowledge is restricted to four species and my observations practically confined to three seasons work, when I was stationed in the Manbhum district where, however, I was able to devote considerable time to their study.

The four species referred to are :—

The Indian Long-tailed Nightjar (*Caprimulgus macrourus*)
The Indian Jungle Nightjar (*C. indicus*)
Franklin's Nightjar (*C. monticolus*)
The Common Indian Nightjar (*C. asiaticus*).

All are resident throughout Chota Nagpur: resident in the sense that they breed in every district and are to be met with during the twelve months, though the Long-tailed species and the Jungle Nightjar are seldom seen between October and February. At one time I was of opinion that these two species occurred here only during the breeding season and it was not until the winter of 1935-6, when I paid several visits to the nesting haunts of these birds that I satisfied myself that both the Long-tailed Nightjar and the Jungle Nightjar are to be found regularly, though uncommonly in Chota Nagpur, during the non-nesting months also. It is clear, therefore, that these two species are subject to a general migratory movement, and though Franklin's Nightjar and the Common Indian Nightjar both occur regularly and even fairly frequently during the cold weather months, there can be no doubt that they too migrate; but not in such numbers as do the two first-named species. The fact remains that from February to October the Common Nightjar and Franklin's Nightjar occur in considerable numbers and the other two less frequently, though sufficiently often to be classed as common. The Common Indian Nightjar is the smallest and the

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Long-tailed species the largest of the nightjars of which I write. Franklin's Nightjar and the Jungle Nightjar are intermediate in size and of approximately equal measurements. They are about 10½ in. in length, the Common Nightjar 9½ in. and the Long-tailed Nightjar—known of yore as Horsfield's Nightjar—is some three inches longer than this.

These different species of nightjars have their particular haunts. The Common Indian Nightjar occurs in gardens, in the open, on the edge of cultivation, and even in thin scrub. Its favourite nesting site is under a palas (*Butea frondosa*) sapling, in a field strewn with small stones and bordered by light jungle. Franklin's nightjar, on the other hand, I have always found nesting on the hillocks and lower slopes of the higher hills, amongst the medium-sized stones which are a feature of its breeding haunts. The site chosen may be quite open or in the vicinity of scrub, which is another characteristic of these hillocks. The bird is really a denizen of the very *fringes* of forest.

The Jungle Nightjar, as its name implies, takes up its quarters more *inside* the forest, often well within. The jungle, however, must be light in character and of a deciduous nature. In my experience the Jungle Nightjar is not met with in deep forest. The Long-tailed Nigntjar, on the other hand usually frequents both thick bush and fairly heavy deciduous and bamboo jungle. It especially favours the banks or the shady, creeper-festooned beds of *nalas* carpeted with dead leaves.

The calls used in the breeding season by these four species of nightjars are distinctive and though it is not possible to identify the birds correctly in the field, it is really quite easy to recognise the species by its call: and let me say at once that the music of the nightjars is well-worth listening to, worth going a long way to hear. It is heard chiefly when dusk deepens into darkness,

'And all the air a solemn stillness holds.'

In the hope that I may be able to convey to the reader some of the joy and thrill I have experienced in listening to Nightjar music, I will quote from my notes written while I was under its spell:—

'It has been a wickedly hot day but now it is pleasantly cool with a gentle breeze blowing. I am seated on a high railway embankment in wild and jungly country. In front of me is a broken open space about three hundred yards long by one hundred yards wide with an outcrop of black rock and just a few bushes and *mhowa* and sal trees; beyond there is rather heavier scrub and deciduous jungle with a *nala* running through it. The water from the nala—when there is any!—passes through a culvert under the embankment where I am seated. Beyond this again, high hills, thickly forested—Jumra to be exact. To right and left of the open space hillocks covered with scrub. Altogether an ideal spot from which to listen to the different nightjars' calls.

It is 5.50. A Peacock has just called from the jungle in front, and a Red Jungle-fowl crowed lustily. Close by a male Robin is singing his jolly jingle.

5.55 and I am startled by a nightjar on my right calling

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chwees on three occasions—startled because I did not expect to hear any nightjar quite so soon. A loud and very penetrating note. The bird was clearly on the wing though I could not spot it. Franklin's Nightjar. Now it is silent and gangmen pass behind me on their way home, their day's work done. Follow several large parrakeets to roost in a small *tope* of trees a mile away, screaming stridently.

6.5. The sun has gone down behind the small hill on the left. More jungle-fowl crowing, followed by the screams of a large flight of green parrakeets and the cachinnating *crescendo* cries of a brain-fever bird. A green barbet also calls from the jungle in front. Dusk is falling fast and the green of the living trees contrasts beautifully with the purple—so it appears in this light—of their sere and leafless neighbours. The silence becomes more intense; but a robin breaks it with its rasping note, and peafowl *mee-ows* in the distance. A single bulbul tinkles tunefully.

6.15. *Chwees* again from the low hilly ground on my right. A small party of green bee-eaters fly across uttering their familiar notes and a green pigeon coos soothingly from somewhere on my left. Now a *'did-you-do-it' pings* piercingly and then flying on gives vent to its usual notes. Obviously some marauding creature has startled it.

6.20. Any minute now I expect to be entertained by the music of the massed bands of the Brigade of Nightjars. Instead a king crow *whippoo-whees* near at hand followed by the green pigeon cooing again but in a much softer key.

Follows a deep silence broken only by the soughing of the wind in the trees.

6.25. *Tuck - tuck - tuck*
Tuck - tuck - tuck - tuck
Tuck - tuck - tuck - tuck - tuck

in the distance, so faint that I can only just hear it. At first it sounds rather like a creaking door being opened and then it somewhat recalls a pebble skimming over ice. Faster and faster come the notes, and though halting in its call at first it now seems as though the bird will never stop. The Jungle Nightjar.

A grey partridge issues its challenge but the predominating call is still that of peafowl although a crow-pheasant is also *whoop - whoop - whooping* and a stone plover delights me with its wild wailing note.

Chwees again, from two different places. One author of these notes flies across, circles and then settles on a largish black stone, spreading its tail a great deal and shuffling from side to side before settling down comfortably. Under the impression that the bird is brooding her young I search for these, but in vain.

Took - took - tookirr-r-r-r.

Took - took - took - tookirr-r-r-r-r, the real pebble over ice this time, right in front of me. The Common Indian Nightjar. Another takes up the refrain and now all three species are calling together from different points of the compass and I don't know which one to tune into so as to give some idea in words of the different calls.

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Chwees flies overhead, calling all the time. I watch it settle on the ground, but then it becomes silent.

The ommon Nightjar is going at it hard, but from the ground. Two, often three, and occasionally four *tooks* before the final *irr-r-r-r.*

And now, what I love most of all to hear, the hammer-note. Like a carpenter striking wood, and the strokes are good and hearty and do not stop. *Chonk-chonk-chonk,* deliberate and loud and with a richness of tone that defies description. This is the call of the Long-tailed Nightjar. It seems to be calling from a tree—certainly not while flying.

A Franklin's nightjar has settled on the very top of a *mhowa* tree, on an almost perpendicular branch, beautifully silhouetted against the clear sky. It is calling *chwees.* repeatedly. Another, also calling, flies within ten feet of my head and although it flip-flaps from side to side and swerves in the usual nightjar-manner, no sound from its wings can I hear.,

6.50, and I can hardly see. Nightjars of all four species calling on every side, Franklin's and the common nightjar predominating. The brain-fever bird still shrieking and any amount of peafowl caterwauling. Unexpectedly a golden-backed woodpecker shrieks, and there is a ring of terror in its notes as though some large owl has seized it.

6.55. The common nightjar's music is dying down but Franklin's nightjar is more in evidence. Only for a short while, however, for now the jungle nightjar's *tuck - tuck - tuck - tuck - tuck* suddenly comes into prominence, followed soon after by the somewhat slower *tuckoo - tuckoo - tuckoo* of the same species. All the notes of this species seem to be uttered from the ground and the number of *tucks* varies greatly; one bird has just *tucked* fifty times or more, calling so fast that it was impossible to count correctly. It sounded much like a horse galloping on a hard road. Is the *tuckoo* note a mating call? there is something warm-blooded, amorous about it which suggests this.

7.10. It is quite dark now and the different nightjars whose notes have each in turn predominated have all stopped calling. The jungle fires on the Jumra range, and on Lugu, behind me, now show up clearly, and the feeling comes over me that it is no longer safe to be out unarmed, that it is time I got back nearer to civilisation. And so the torch is switched on—to lighten our darkness—and I pick my faltering way back to my saloon, my heart overflowing with joy from all I have just heard and seen.'

Of course, other notes are also used, perhaps more generally than is imagined. For instance, a common Indian nightjar early one morning after calling in the normal manner treated me for quite ten minutes to a delightfully sweet and musical variation *took - took - terro - oi - ick.* This was in my garden at Dhanbad and since then I have occasionally heard it elsewhere. Again, visits just before dusk to the nesting haunts of long-tailed nightjars have proved to my satisfaction that when this species first leaves its diurnal resting place—and even before—the call commences with a croak rather like a frog's. The note is, however, low and sounds

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Jungle Nightjar (*Caprimulgus indicus*).

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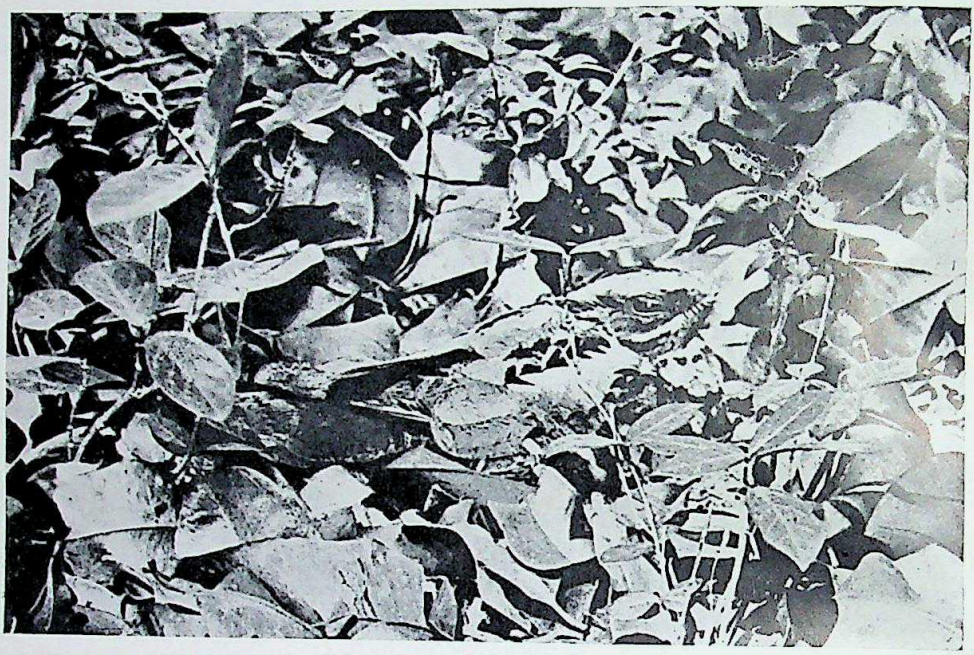

Camouflage: Common Indian Nightjar brooding, (*C. macrourus*).

Young Common Indian Nightjar.

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far off. After a short while it changes straight into the usual call which at first is repeated only two or three times. Following a pause the bird *chonks* for two or three minutes with usually three *chonks* to each series and then repeats its note just once or twice for a brief period. Thereafter it usually breaks into sustained calling. It sounds just as though the bird were tuning up and had at last found the right pitch. The Long-tailed Nightjar also occasionally utters another note, a particularly sweet *wog* which must be heard really to be appreciated.

I have never *seen* a jungle nightjar calling so am unable to say definitely whether this species calls from the ground, a post, or tree. Judging from the *direction* of the sound, when I have heard the note at close quarters, I am of opinion it calls *only* from the ground. Franklin's nightjar calls just as frequently while flying as from the ground, or from a post or even tree-top. The Long-tailed Nightjar, on the other hand, utters its normal call only from the ground or a tree, or from a branch low down or one high up. I have heard it use the croaking note when on the wing pursuing another of its species; but this note is generally used while sitting on the ground amidst masses of dead leaves, before taking its first flight of an evening. Sometimes it is uttered from the branch of some stunted tree or thick creeper in the jungle immediately after the day-time roost is left and before it starts calling *chonk*. The Common Indian Nightjar differs from the three preceding species in calling apparently only from the ground, a boulder or even a low post, but *never*, I think, from a tree.

Nightjars start calling about the beginning of February and continue to do so regularly till the middle or end of July, that is to say, during the main breeding season. Thereafter their notes are less in evidence although I have known the Common Indian Nightjar call sporadically till 7th October. This symphony, as I remarked earlier, is to be heard chiefly as dusk is turning to darkness. The different cries are, however, very much in evidence again for an hour or more before dawn breaks and throughout the night when the moon is at her zenith.

Anyone who has examined a nightjar in the flesh must have noticed the very long middle claw, the inner edge of which is serrated and has a comb-like appearance. The use of this pectinated claw still remains a mystery. Long years ago, Gilbert White was of opinion that it helped the bird to deliver food into its enormous mouth, an assertion which as yet has no evidence to support it. Others consider its function is to comb from the stiff bristles of its gape the wings of moths and beetles upon which it feeds. There are objections to this theory. Flycatchers possess similar bristles about the gape, but do not have pectinated claws to clean them, and other species have such a claw but no bristles to wipe. Nevertheless, the explanation is one which has fairly general support. My own contribution to the problem is, I fear, scanty. I have only once seen a Nightjar bring its foot up to its mouth. The impression I then obtained was that the bird was using its claw to remove something from the side of the mouth—it was certainly not to put anything in.

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Whistler has stated on more than one occasion that Nightjars cannot travel on foot and asserts that the long central toe prevents progression over the ground. Such a handicap possibly discourages the birds from travelling any great distance in this manner, but it most emphatically does not prevent a nightjar from movement over ground. As a matter of fact, nightjars begin to hop, and even to run, at a very early age. On 14th July 1935, a long-tailed nightjar, I was photographing, settled on a branch of a tree not far from which were her two chicks, the younger not yet forty-eight hours old. Flying down to the ground, she used the croaking note I have already described. Receiving no response from her chicks, she ran four or five feet towards them, her wings erect, their tips nearly meeting over her back. Again she called, and this time both young ones left the spot where they had been born and travelling a distance of quite ten feet finally reached their parent, under whom they took shelter. The larger chick covered the distance by running and hopping, holding up its wings when running in exactly the same manner as the parent bird had done. The smaller chick progressed by hops alone, a couple of inches or so at a time. I have also seen young common Indian nightjars, about a week old, hop in precisely the same manner for double this distance. Again, I once alarmed a Franklin's nightjar which could almost fly. The bird ran in several short bursts with wings upraised while I attempted to catch it.

If young nightjars hop and run well, their parents are even more proficient in progressing over the ground. Nightjars usually alight straight on to their nests. Not uncommonly, however, they settle on the ground some distance away. This may be anything from five to fifteen feet. I once watched from the *hide* a Franklin's nightjar work its way back to the nest from a distance of over fifteen yards. On such occasions the bird progresses either by a series of short runs, with wings carried almost vertically over the body, when it looks for all the world like a sprinter breasting the tape, or the wings may not be lifted at all; or the bird walks a short distance, halts for a space and resumes the journey in a similar manner. The gait then is most peculiar—it is either a waddle like a rook's or a shuffle, as though the bird were wearing a hobbled skirt.[1]

Just as the sight of a *Did-You-Do-It*'s nest containing eggs always thrills me, so too I never tire of watching yet another nightjar sitting on her eggs. How wonderfully the plumage of the bird blends with its surroundings. Let it sit upon a carpet of dead leaves, under a tiny sapling, or in the open surrounded by a few stones, and a stick or two—it does not seem to be a bird at all but part of the ground on which it rests. The illusion is made more perfect by the manner in which the bird rests with

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[1] Since I wrote this my attention has been drawn to *The British Bird Book*, vol. 2, p. 374, where, referring to the Nightjar, appears the following statement :—

'Both young and old, it may be added, run easily.'

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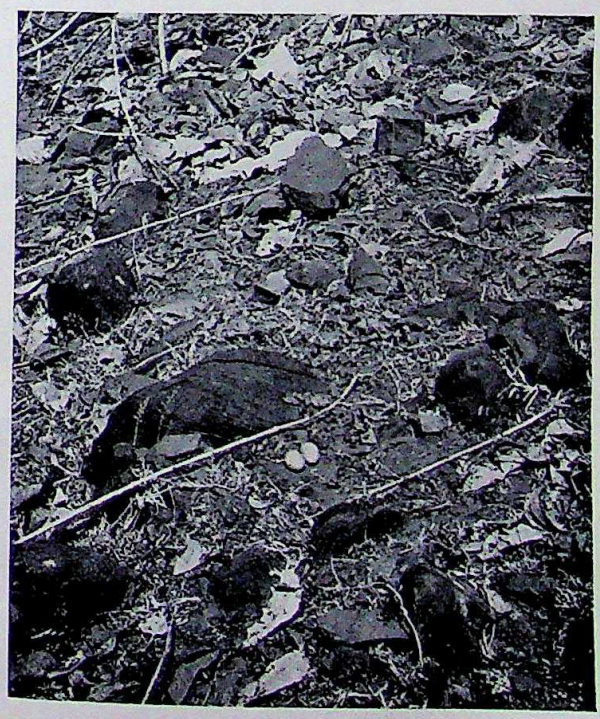
Franklin's Nightjar (*Caprimulgus monticolus*).



Eggs of Franklin's Nightjar.

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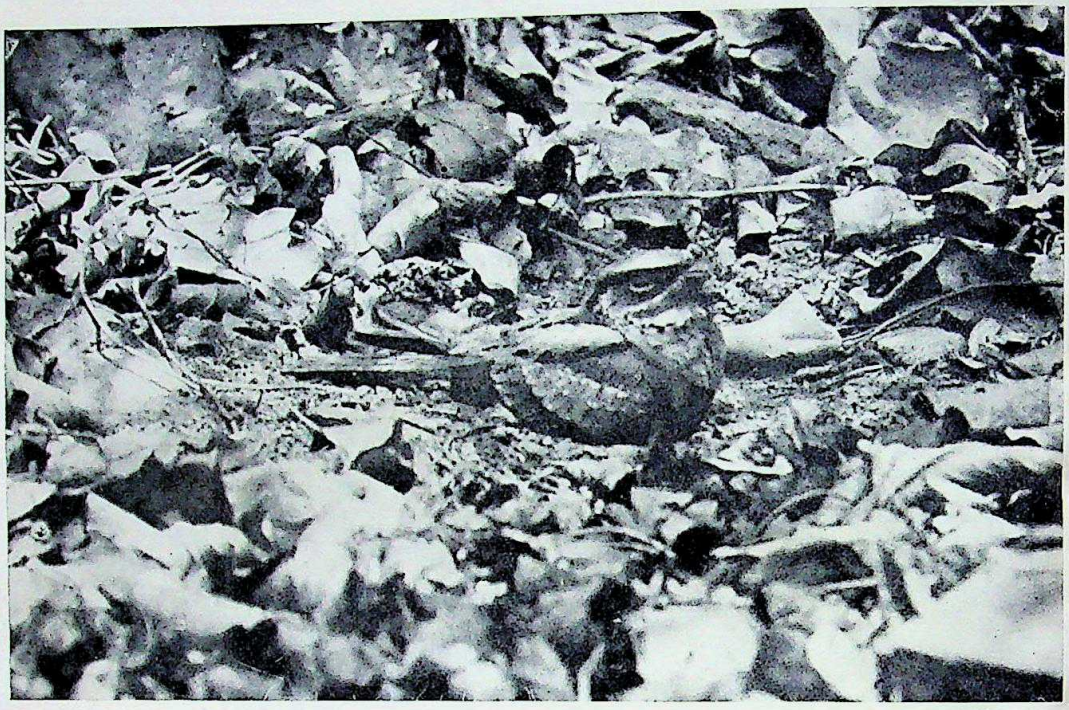

Indian Long-tailed Nightjar (*Caprimulgus asiaticus*).

Indian Long-tailed Nightjar.

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its eyes closed or almost so. Again and again have I shown a nightjar covering her eggs to some friend; always—even when we have been within a few feet of the bird—he or she has taken some time to spot it; and great always has been their wonderment at seeing this perfect example of protective coloration.

The photography of nightjars as a rule presents no difficulties; indeed, the use of the *hide* may generally be dispensed with in the case of the Common Indian Nightjar. Frequently, I have worked my way up slowly to one of these birds as she covered either eggs or young, less than a foot at a time, my head under the focussing cloth and the camera screwed to the tripod, and have so taken all the photographs I wanted. It is, however, terribly hot work and the perspiration has poured down my face until I have literally been blinded and have had to remove my glasses constantly so as to be able to focus correctly. When so occupied, when the tripod will not remain where it is put, when the focussing cloth sags or a high wind causes it constantly to obstruct the view, one's temper runs short, and the language I have then used—well, what else would one expect! In spite, however, of the noise I have then made; in spite also of the camera and tripod falling down within four feet of the sitting bird, either due to my own clumsiness or a gale blowing it over, I have twice known a common Indian nightjar continue to incubate, with eyes still closed, as though nothing untoward had occurred!

I have also photographed Franklin's nightjar without using the *hide*. This, however, has been exceptional. Usually the bird's courage fails it when the photographer is about fifteen feet away, which, of course, is not within camera range. This is probably due to the fact that in Chota Nagpur the species is greatly harassed by the aborigines who kill the bird on every possible occasion. The *modus operandi* being to approach it stealthily from behind and hit it with a slender V-shaped branch on the end of which the foliage still remains. Once alarmed, this species cannot be stalked and recourse will then have to be made to the hiding tent which should be erected some distance away and only moved closer to the nest as the sitting bird becomes used to it. Even when the would-be photographer is safely enclosed—is in *purdah*, as an Indian friend once expressed it—a considerable interval will most certainly elapse before a natural portrait can be secured, due either to the bird sitting unnaturally—eyes wide open and bolt upright—the skin under the chin vibrating at an alarming rate a sure sign that the bird is frightened or suspicious.

There is one feature of an incubating Franklin's Nightjar that at once distinguishes it from the other species with which this article deals—this is the buff-coloured V which extends roughly from the shoulders to half way down the back. It is strange that no observer should have drawn attention to this marking which is partly brought out in the accompanying plate.

I have found remarkably few nests of the Jungle Nightjar considering the numbers of this species which are to be heard throughout the Chota Nagpur Division. Whether this has been due to my keeping one eye open to the possibilities of a Russell's

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Viper—habitat Manbhum, if the famous 'Tiger' Knowles is to be believed—or whether my failure was attributable to inertia brought on by the terrific heat, to which advancing years made me more susceptible than was the case a decade previously, I cannot say. The fact remains that I always found this species very quick to leave its eggs, once it knew they had been spotted, and equally loth to return to them. There can be no doubt that, here again, this is due to the manner in which the aborigines harass and destroy this species when incubating. Two cases immediately come to mind of scattered feathers and broken shells where only the day before I had gazed with admiration and joy on a Jungle Nightjar incubating its two eggs.

I did not succeed in finding the eggs of the Long-tailed Nightjar until the summer of 1935; this was entirely due to my searching for them previously in scrub or thin jungle. When, however, I started looking for them in deeper forest round about the *nala* beds, I was immediately successful. The eggs of this bird are appreciably larger than those of the other nightjars and are in addition differently coloured, their ground colour being of a creamy hue in contrast to the salmon-pink of the other species.

The *New Fauna*[1] states that the Long-tailed Nightjar is 'an exceptionally confiding, tame bird'. This may be the case in Assam, but it was not long before I was disillusioned with regard to residents in the Manbhum district. Why they should be so very shy here is beyond my ken because, when breeding, the species is free from the attentions of the local savage who, I discovered in due course, is not aware that nightjars breed in such heavy jungle. Be the reason what it may I was soon to learn that in these parts *albonotus* invariably leaves its eggs or callow young when the intruder is fifteen feet or more distant from its treasures, and, although it will then return to them, he can be certain that the third time he goes to investigate affairs he will find the eggs lying deserted in the so-called nest, or the young removed—may be they are enticed away—so that it is almost hopeless to expect to see them again. Such shyness on the bird's part seemed to put its photography beyond the realms of possibility. However, it is an occasion such as this which brings out the best in the really keen bird photographer and observation indicated that success could only come my way if I refrained from flushing a bird off its eggs a second time, observing it instead from a distance through the glasses until I was satisfied that the young had made their appearance. Pursuing these tactics I eventually—after several failures—succeeded in photographing the Long-tailed Nightjar at home when her eggs were actually hatching. The jungle, however, was heavy and the light consequently poor, necessitating, of course, the use of a large stop so that the resultant pictures lack that detail I should like to see. I believe that this particular bird would have permitted me to expose all twelve plates on her that morning. Alas! when pulling the roller-blind chord preparatory to taking the third photograph the

[1] Vol. iv, p. 365.

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Thornton-Pickard shutter broke and, as usual on such occasions, there was nothing I could do to remedy matters for the nonce. I therefore dismantled the hiding tent and camera just where they stood, the bird making no attempt to leave the eggs. Then did I ask myself on whose unlucky countenance had I gazed when I first awakened that morning; and when I put the same question to my *shikari* he supplied the reason for our bad luck. When he came out of his hut that morning he had happened on an old woman who always brought him ill fortune; he had intended to tell me earlier about this dreadful calamity but finally decided to keep silent on the point lest I should rate him for a superstitious old fool. But now he was convinced; and so on, until I bade him shut up. Of course, when I returned four days later, it was to find that the young ones had been removed, where I knew not.

I have succeeded in photographing only one other long-tailed nightjar. Here again the conditions were just the same as before, except that in this instance the photographs I succeeded in taking of the parent bird covering its young will not permit of reproduction owing to the way in which sunshine and shadow alternate on the bird's back. Fortune however favoured me, as during the next two days when the young were very small, the long-tailed nightjar almost invariably alighted on a branch a few feet from the nest thus enabling me to take a number of pictures showing the bird's long wings and white markings on the primaries, one of these is reproduced herewith.

In suitable places the Manbhum district is a veritable paradise for nightjars. How common the genus is may perhaps be gathered from the following statement of fact. When first I made Sukroo's acquaintance I was anxious to obtain some photos of a Nightjar —did he know the bird and had he ever found its eggs? Yes, he was familiar with the *chuckoo* and had often found its eggs and young. Thinking to put him on his mettle I wagered him a rupee that he could not find me twelve nightjars' nests that day. Although I felt rather guilty of betting on what I considered was a certainty—if there is such a thing—I nevertheless lost the bet!

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NOTES ON SOME BIRDS RECORDED FROM BURMA.

BY

P. F. GARTHWAITE, B.F.S.

assisted by

DR. C. B. TICEHURST, M.A., M.R.C.S., M.B.O.U.

The following notes refer to birds collected by the writer in various localities in Burma from 1932 to 1935. In every case the identification has been made or verified by Dr. C. B. Ticehurst, M.A., M.B.O.U., to whom the writer is greatly indebted for constant help. The nomenclature adopted is based on that of the *Fauna of British India*, 2nd Edition (referred to hereafter as *F.B.I.*) and the notes made are only those which it is thought expand the present scope of the *F.B.I.*, particularly as regards distribution. The attached map shows the position of localities from which birds referred to were collected. All these birds were collected in the plains or foothills below 2,000 ft. Dr. C. B. Ticehurst is responsible for the identification and systematic notes, and his contribution is added in brackets.

[**Garrulax leucolophus hardwickii.**

Garrulax leucolophus belangeri. The Burmese White-crested Laughing Thrush.

In the Bulletin of the *B.O.C.* (vol. xlvi, p. 113) I described *Garrulax leucolophus hardwickii* from the Naga Hills and gave as its rough distribution Assam and N. Burma. This form was added in the addenda of the *F.B.I.* (vol. viii, p. 509) but the distribution given there was *Garhwal* and N.-W. Himalayas. We are now in a position to detail the ranges of these two forms more accurately than has been done before.

G. l. hardwickii in Burma occupies the Kachin Hills in the North, and even occurs there as low as 100 ft.; the small ranges of Gangaw and Mingin in the Katha and Shwebo Districts; Mogok 4,400 ft.; has been recorded (as *leucolophus*) on the borders of N. Shan States and Yunnan (Malipa); the Chin Hills and the outliers between the main range and the Chindwin river (Pondaung Range); Arakan Yomas.

G. l. belangeri.—From Tavoy in Tenasserim northwards in lower hills 300-1,000 ft. or plains i.e., S. Shan States where it is said to go not higher than 2,800 ft.; Pegu, Rangoon, Bassein, Tharrawaddy, Prome, Toungoo, Pyinmana, it extends north along the foothills east of the Irrawaddy in the Maymyo Mogok divisions to 23° N., the higher hills here being inhabited by *hardwickii*.]

[**Pomatorhinus schisticeps nuchalis.** Tweeddale's Scimitar Babbler.

Pomatorhinus schisticeps mearsi. Grant's Slaty-headed Scimitar Babbler.

Pomatorhinus olivaceus ripponi. Harington's Shan Scimitar Babbler.

These three birds call for some comment for various reasons.

Firstly, the *F.B.I.* puts *nuchalis* as a species but I think it may well be a race of *schisticeps* for the following reasons:—

From Arakan, Chin Hills east to the Irrawaddy river the form is undoubtedly *mearsi*, but a bird from Chaungzon Shwebo is exactly intermediate; it has the white streaks in the side of the breast of *mearsi*, but in size is *nuchalis*; on the east side of the Irrawaddy *nuchalis* is the representative.

Secondly, it is tempting to put *olivaceus ripponi* as a further race of

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schisticeps and this has been done by some authors. The chief differences are the smaller size, shorter bill and lack of chestnut feathers in the flanks. In favour of this is the fact that birds from Maymyo are intermediate in the question of the flank feathers, that is to say the chestnut colour is not nearly so marked as in typical *nuchalis* and indeed some are quite like *ripponi* in this respect but in size are *nuchalis*. But against this arrangement we certainly have *nuchalis* and *ripponi* in Mogok district and apparently at Bampon and Kalaw and probably elsewhere in Southern Shan States. Moreover *olivaceus olivaceus* occurs together with *nuchalis* at Thongyat, N. Tennasserim. It must be noted that the birds from Mogok were obtained at different elevations 300 and 3,700 and so the possibility that one (*olivaceus*) is a bird of higher elevation must not be lost sight of; where the two forms have elsewhere been obtained in the same locality details are not sufficient to say whether there was an altitudinal difference or not.

It is a point which collectors would do well to take note of.

Thirdly, many of the measurements given in *F.B.I.* are not correct. I have measured every bird in the British Museum and many more besides and I find the following measurements.

Mearsi. Wing 102-112 mm., tail 105-116 mm., bill from skull 34.5-38 mm.

Nuchalis. Wing 88-102 mm., tail 92-103 mm., bill 27-32 mm.

In *F.B.I.*, the wing measurements as given 87-91 can only apply to the smallest: the tail, as given, 210-220 mm. and corrected in vol. xiii, to 110-120 is very wide of the mark.

Ripponi. Wing 82.5-90 mm., tail 88-97 mm., bill 23.5-26 mm.]

Gampsorhynchus rufulus rufulus (232). The White-headed Shrike-Babbler.

One specimen, May 1935, Nanhlaing Reserve, Shwebo Forest Division.

Three specimens, January 1936, Namma Reserve, Bhamo Forest Division.

The bird shot in the Shwebo Division had legs fleshy white, of a bluish tinge, a characteristic according to the *F.B.I.* of the Southern *G. r. torquatus* whose distribution is given as 'The Toungoo Hills and Karenni to Tenasserim', while the distribution of the Northern race is given as 'Chin Hills and Arakan'.

Both localities from which this bird was collected are heavily wooded, containing evergreen forest in the foothills, with hills rising above 4,000 ft. behind them.

(This race has been recorded by Harington from the Jade Mines, Myitkyina District, and from the foothills of the Henzada Yomas by Mr. Stanford.)

Napothera brevicaudatus venningi. Venning's Wren-Babbler.

One specimen from Gokteik, Hsaipaw North Shan States.

(Although this distribution in the *F.B.I.* is given as South Shan States, Burma and Yunnan, there are no specimens in the British Museum, nor are there any records from any part of Burma except the South Shah States.)

Stachyridopsis rufifrons rufifrons (279). Hume's Babbler.

Five specimens, March 1935, Thogale, South Toungoo Forest Division.

Two specimens, August 1935, Nanhlaing Reserve, Shwebo Forest Division.

One specimen, November 1935, Thogale; one Monhnit, Pyinmana, December 1935.

The birds obtained in March at Thogale appeared to be breeding, as nesting material was observed to be taken by them, but no nests were found. The *F.B.I.* gives the distribution as 'Shan States of Tenasserim' but these records prove a more westerly range. Thogale is on the eastern slopes of the Pegu Yomas where there is abundant evergreen vegetation.

[Though this is probably not a rare bird, yet very few specimens have hitherto been obtained. The distribution is far from being worked out at present, but it certainly occurs also on the west of the Pegu Yomas (whence came the type in Lat. 19) and Mr. Smith has obtained it there also in the Yetho Yomas, Tharrawaddy Forest Division.]

Criniger tephrogenys griseiceps (382). Hume's White-throated Bulbul.

Seven birds from the Thogale locality, South Toungoo Forest Division, and two from the Kaing Reserve, Pyinmana Division.

Both localities are humid, well-wooded, with abundant ever-green forest, and the bird is found in small parties in the densest undergrowth.

(In the *Journal*, vol. xxxvi, 925, I pointed out that Oates obtained five specimens of this bird in the E. Pegu Hills in the seventies of last century

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and that no one since had met with it. It is, therefore, of considerable interest to find that Mr. Garthwaite has re-discovered this bird in the same range as Oates originally found it. Oates said it occurred as far north as the latitude of Thayetmyo. Mr. Garthwaite has extended it a little farther north to the Kaing Reserve in Pyinmana Division. The distributions of *Criniger* species and races in Burma need far more attention before their distributions and relationships can be satisfactorily made out. The parts which need most attention are the hills on east side of the Sittang river and southwards to the Amherst District.)

Criniger flaveolus flaveolus (380). The Indian White-throated Bulbul.

One specimen, August 1934, Nanhlaing Reserve, Shwebo Forest Division.
One specimen, May 1935, Pile Reserve, West Katha Forest Division.
One specimen, January 1936, Sinkan Reserve, Bhamo Forest Division.

These three skins agreed with none of the descriptions in the *F.B.I.*, of birds said to occur in Burma, and were identified by Dr. Ticehurst as this race, for which Burma is not included in the distribution given in the *F.B.I.*

[I have already (*Journ. Bom. Nat. Hist., Soc.*, xxxvi, pp. 423-4) pointed out that *Criniger gularis* (Horsf.) is preoccupied and cannot be used for the Indian bird which I have previously recorded from Arakan and the Katha District.]

Iole virescens virescens. The Olive Bulbul.

Iole virescens propinqua.

Various specimens of this species from Kaing Reserve, Pyinmana, Satchaung, S. Toungoo, Gwethe Reserve, N. Toungoo, Pile, Katha, Gangaw, Maymyo; Simaw Reserve Bhamo.

[The type of *Iole virescens virescens* came from Arakan, and these birds from N. and S. Toungoo Divisions and from Pyinmana are *virescens* or nearest that form; the birds from Katha, Maymyo and Bhamo are clearly not the same race; they are larger and have darker, cinnamon undertail coverts and I place them with *propinqua* which has already been recorded from the Myitkyina District (*Ibis* 1935, p. 249). The bird from Gangaw is also nearest to *propinqua*.

Bingham obtained this form in Mong Kong, Shan States (specimen examined in British Museum).

With a widely distributed species such as this there must naturally be intergrades between *virescens* and *propinqua* in Burma.]

Larvivora cyane (483). The Siberian Blue Chat.

Five specimens from Gangaw, Yaw Forest Division in February 1934.
One specimen from Thogale, South Toungoo Forest Division in March 1935.
One specimen from Gwethe Reserve, North Toungoo Forest Division in November 1935.
One specimen from Kaing Reserve, Pyinmana Forest Division in December 1935.

Gangaw is on the east bank of the Myittha river at the foot of the Chin Hills, which rise up from the west bank.

This migrant has previously only rarely been recorded from Burma, but these collections show that it is widely spread over the country in the winter months. It was found in Bamboo jungle, scratching about in dead leaves on the ground, and often met with on sandy paths.

(Though the distribution in the *F.B.I.* is given as 'Burma' it has only been recorded from Pegu once; Thandaung, Toungoo once; and Southern Shan States once. In Tenasserim it was recorded as common by Davison and Bingham.)

Rhodophila ferrea ferrea. The Western Dark Grey Bush-chat.

Specimens from Maymyo, Pyinmana and S. Toungoo in winter.

[In the *Journal* (vol. xxxvii, p. 357) Mr. Kinnear says he can see no difference in winter plumage between *ferrea* and *haringtoni*. With this I agree; all the Burmese birds I have seen seem quite the same as Himalayan ones. Hartert in his description of *haringtoni* stressed the shortness of the tail, the measurements for which he gives as 57-61.5 mm. Kinnear gives for *ferrea* 59-65 mm. Seventeen males from Burma in winter measure:—Tail 59-68 mm.—and I must therefore place them with the typical race.]

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Luscinia obscura.

Shot in January 1936 in the Simaw Reserve, Bhamo Forest Division about 500 ft. above sea level. The bird was seen in thick undergrowth on the side of a stream, and the tail was unfortunately damaged in shooting. The locality is at the foot of the high mountains which run into the Sinlum range. Only the one bird was seen.

[This is a remarkable addition to the Burmese Fauna. Very little is known about this species which breeds in S.-W. Kansu and in the Tsin-ling Range. In the former place Beresouski discovered it originally and Owstroi's Japanese collectors found it in the latter, and beyond a few (?) specimens in Russian Museums there appear to be four adult males only in the Tring collection. To the kindness of Dr. Mayr of the American Museum of Natural History the satisfactory determination of this specimen is due, as there is no specimen of *Luscinia obscura* in the British Museum. He informs me that as the females in this genus have the upper parts brown and that as in this specimen the upper parts are slate-blue, as in the adult males, he considers it to be a male in the first year, and in a plumage which is unknown.

This is very likely to be so, assuming of course that there is no distinctive breeding dress. The adult male in summer has a black chin throat and breast, whether this is retained in winter is not known.]

The following is a description of this bird.

Luscinia (larvivora) obscura. Presumed male in first winter.

Upper parts near dusky slate blue (*Ridgway* xliii, m) lores and malar streak black; earcoverts and indistinct supercilium ochraceous grey; chin and centre of belly whitish; rest of under parts with axillaries and under-wing dull pale ochraceous with indication of 'scalloping' due to faint dark edges; flanks tinged with olivaceous; thighs blackish; wings black edged with colour of mantle on tertiaries and coverts. Tail missing.

Wing 69.5, tail ?, bill 16 from skull, tarsus 27.

Second primary between seventh and eighth.

Dr. Mayr informs me that the measurements and structure of wing and bill closely correspond with males from the Tsinling Mountains, and suggests that the black malar streak foreshadows the black shield of the adult. He further points out that one of the adult males in the Tring collection has one ochraceous feather in the black shield similar to those on the breast of this specimen.]

Monticola solitarius pandoo. The Indian Blue Rock-Thrush.

I obtained several Blue Rock Thrushes at Gangaw in the winter and one from Pyinmana, which have been identified as belonging to this race.

[The *F.B.I.* says possibly this form winters in North Burma. Mr. Stanford has already recorded it from Myitkyina and Mr. Garthwaite's specimens now show that it is much more widely spread.]

Seicercus cantator (895). Tickell's Flycatcher Warbler.

Two specimens from Baw Reserve, Maymyo Forest Division, December 1934.

One specimen from Kaing Reserve, Pyinmana Forest Division, December 1934.

One specimen from Simaw Reserve, Bhamo Forest Division, January 1936.

Previous records of this bird are rare and its distribution in Burma is given in the *F.B.I.* as 'Chin Hills' and 'Karen Hills'. These three records are, however, widespread, and are all from the foothills below 1,000 ft.

(Beyond the statement in the *F.B.I.* that this occurs in the Chin Hills I know of no record thence. Oates in the *Birds of British Burma* gave near Toungoo in the Karen Hills, where Wardlaw-Ramsay had met it, and nowhere else. In the British Museum the only Burmese specimen is one of Wardlaw-Ramsay's from this locality and Walden describes it as a new bird, *Abrornis chrysea*. This species doubtless has been and is largely overlooked. Burmese birds do not appear to be any different to those from Sikkim.)

Æthiopsar grandis. } The Jungle Myna. One specimen from Katha.
Æthiopsar fuscus. } Four specimens from Pyinmana.

The *F.B.I.* gives the distribution of *fuscus* as the whole of Burma to Rangoon and of *fuscus torquatus* as Peninsula of Burma and Siam.

As regards *fuscus* I do not think this distribution can be correct. The farthest north in Burma from which I have seen specimens is from Pyinmana but there are records from *Myingyan*, yet the districts round Shwebo, Maymyo

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and Myitkyina in Upper Burma have been intensively worked by Messrs. Stanford, Smith and Garthwaite for some years now without a single specimen being obtained. There are eight records of it from the Chin Hills, Arakan and Southern Shan States but there are no specimens thence in the British Museum. The distribution leaves one in doubt as to which form is found in N. Tenassetim where the bird is evidently very common. I have examined a number of birds from Tenasserim and I cannot see that they differ from those from the rest of Burma or from those of Northern India.

Series from Sikkim Bengal, wing 120-127.5 mm.
Series from Tenasserim, wing 120-126 mm.
Series from Malay Peninsula, wing, 118-134 mm.
Series from Burma (lower), wing 120-128, 130, 133 mm.

The Malay bird (*torquatus*) was described from Pahang and is said to be smaller. I do not feel convinced that there is any colour difference between *torquatus* and *fuscus* and on a series only 5 out of 13 are a trifle smaller than Indian birds. It has no place in the Burmese avifauna.

Fuscus extends from India through Dacca, Tipperah and Mymensing to E. Assam (but not to Manipur) and then it is seemingly distributed through Arakan (Hopwood) and the plains of Lower Burma from Pyinmana south and throughout Tenasserim (but not in the hills between Tavoy and Siam) to the Malay Peninsula.

The *F.B.I.* divides *grandis* into two forms *grandis grandis* from the S.-W. Burma and E. Burma, South Shan States and Karenni South to Tenasserim and *grandis infuscatus* from N. Burma and Arakan, Manipur, Eastern Assam and Assam, south of the Brahmaputra. I have examined all the material in the British Museum and this does not bear out the distribution as given above. There are no specimens from Assam, and from Manipur only from the south and south-east; there are no specimens from S.-W. Burma. I find that in Burma it occurs in the North in Myitkyina, Bhamo, Katha, Mogok, Maymyo, Upper and Lower Chindwin Districts as far as Mingin; in Karenni and Southern Shan States; from Tenasserim there are two specimens said to have been taken on the Tenasserim river, that is in the hills which divide Tavoy from Siam. Hume particularly stressed that they were *said* to have been taken there; the labels are not those of the original collector and Davison never met with the species in Tenasserim, nor did Willoughby Lowe. So the fixation of the type locality for *grandis* as Tenasserim was not a very happy one. Outside Burma it extends through Siam to French Indo-China.

Birds from Upper Burma, including the Chindwin whence came the type of *infuscatus*, do not seem to me to be different to those from the Tenasserim river and Siam. The differences relied on are partly due to individual variation and partly due to wear.

I regard *infuscatus* as a synonym of *grandis*.

Series measured, wing 128-146 mm.

The question then arises—what is the relation between *grandis* and *fuscus*. From the distribution of these two which I have given above it appears that *grandis* and *fuscus* do not occur anywhere together. It is true there are eight records of *fuscus* in the Chin Hills and Shan States and of *grandis* in N. Tenasserim at Kawkariyet (where only *fuscus* has been obtained) but until specimens are forthcoming to prove that the two forms occur together I think we must accept the fact that, so far as is known, they do not do so.

As bearing on this point a series of hides obtained in the foothills of the Maymyo District 300-500 ft. by Messrs. Smith and Garthwaite are instructive. One specimen is indistinguishable from *grandis*, two are nearer *grandis* than they are *fuscus* and two I can only consider to be intergrades between *grandis* and *fuscus*; these have the dark mark at the base of the lower mandible indicated, but not perhaps quite so marked as in *fuscus*, the colour of the upper and underparts are dark for *fuscus* and pale for *grandis*, the upper parts being distinctly paler than the crown (in *grandis* crown and upper parts concolourous); in size they might pass for *grandis* and are large for *fuscus* wing 130-36. In this connection too, it may be noted that the largest *fuscus* of any came from Pyinmana, wing 128, 130,. 133—larger than any others I have measured, but in every other character these birds are typical *fuscus*. Between Pyinmana and Maymyo there are no specimens available of any form.

The evidence, then, so far as I have been able to gather it, is that *fuscus* and *grandis* do not occur in the same area and that in the foothills

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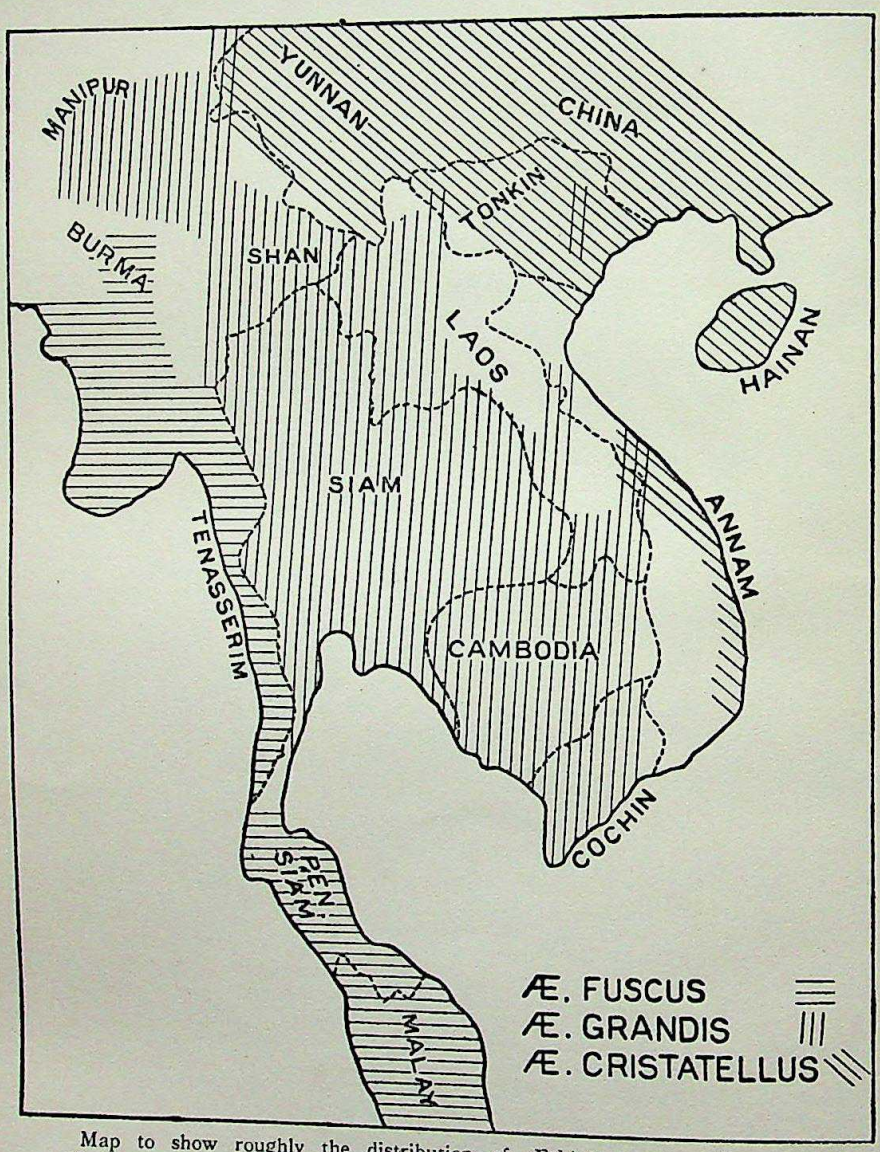

Map to show roughly the distribution of *Æthiopsar cristatellus, grandis* and *fuscus*. To show overlap of *cristatellus* and *grandis* and meeting ground of *grandis* and *fuscus*.

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between Mandalay and Maymyo there is some evidence of intergradation between the two; the two must, therefore, be considered to be conspecific.

A further question arises as to whether *cristatellus* is conspecific with *fuscus* and *grandis*. Besides the rather duller plumage *cristatellus* differs from *grandis* in having the under-tail coverts black with narrow white tips and *narrower* white tips to the tail. I may here remark that in N. Burma *grandis* sometimes has the undertail coverts partly black, but always with broad white tips and broad white tips to the tail. *Cristatellus* occurs throughout South China to Szechwan and is represented in French Indo-China by a slightly smaller form (*brevipennis*). From the rather extensive material in the British Museum and from M. Delacour's record (Les oiseaux de l' Indochine française) it appears that *cristatellus* is the bird of Tonkin and the sea bird of Annam south to Phan Rang. The rest of Indo-China and Siam, west to the Shan States and Karenni is inhabited by *grandis*. But *grandis* also occurs in at least two places in Tonkin (Long Son and Laichan) side by side with *cristatellus* and also on the Annam coast in the neighbourhood of Vinh, Guantu and Hué'. Birds from these places are clearly one or the other of these forms and no intergrades have been found. Moreover Delacour indicates rather different habits, and so although there is another whole geographical replacement between *cristatellus* and *grandis* the evidence at present is that they behave as species which replace one another.

Furthermore, in N.-W. Yunnan both occur. Rothschild (*Nov. Zool.*, xxxiii, p. 339) records *grandis* from Muanghu and from the hills N.-W. of Tengyueh (Momien) and *cristatellus* from the latter place and from Malipa in N. Hsenwi, N. Shan States, close to the Yunnan boundary, on the authority of Bangs (Andrews-Heller coll.). Presumably this bird from Malipa has been correctly identified and so *cristatellus* should be included in the Burmese avifauna, though it is omitted in the *F.B.I.* In the rest of Yunnan (Lichiang Range, Yoaknan, Hsiao and Mengtze) *cristatellus* only is recorded.

There seem to have been several mistakes made in the names of the Jungle Mynah, which date back to Horsfield and Moore's Catalogue 1858. The first name proposed was *Pastor griseus* Horsfield (*Trans. Linn. Soc.*, xiii, p. 154, 1820) for the Javan Crested Mynah. This name in the above Catalogue was set aside because Daudin in 1800 (*Orn.* ii, p. 286) used *Gracula grisea* as a new name for Latham's *Turdus ginginianus* (*Acridotheres ginginianus*). Moore was correct in doing this because he put the Jungle Mynahs in the same genus, *Acridotheres*, as the Common and Bank Mynahs. If, however, as Oates did in 1889, the Jungle Mynahs are removed to the genus *Æthiopsar* then *Pastor griseus* is not preoccupied by *Gracula grisea* and becomes the oldest name, for the bird usually known as *Æthiopsar javanicus*. *Æthiopsar grandis grandis*, *F.B.I.* could not be the correct name since *grandis* (1858) is only a race of *javanicus* (1850); the name used should have been *Æthiopsar javanicus grandis*; for this reason, too, Chasen's *Æthiopsar grandis javanicus* is equally incorrect (Hand-list of Malaysian Birds.)

The eastern forms then will stand as

AETHIOPSAR GRISEUS GRISEUS (Horsf.) *Trans. Linn. Soc.*, xiii, p. 154. 1820—Java.

AETHIOPSAR GRISEUS GRANDIS (Horsfield and Moore) *Cat. B. Mus.* East India Coy., p. 537. 1858 Sumatra (in error=Tenasserim).

AETHIOPSAR GRISEUS FUSCUS (Wagler) *Syst. Av. Pastor* sp., 6, 1827 India—E. Bengal.

and

AETHIOPSAR CRISTATELLUS CRISTATELLUS

AETHIOPSAR CRISTATELLUS BREVIPENNIS Hartert *Nov. Zool.*, xxii, p. 250. 1910—Hainan.

Munia punctulata lineoventer. The Spotted Munia.

Specimens from Maymyo and Katha.

[In the *F.B.I.* the type locality of *punctulata* is given as Calcutta. Linnaeus' name is based on Edwards' pl. 40 of the Natural History and Edwards said it came from the West Indies where it was sold for a Gowry (Cowry). From this it seems unlikely that the bird came from Calcutta and Edwards' plate does not represent the Indian bird. However, Gmelin in 1789 fixed on Java as the type locality and this can be accepted. The Indian bird should be called *Munia punctulata lineoventer* Hodgs. A race *subundulata* was described from Manipur but many Assam and Burmese birds are indistinguishable from

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Indian ones and all seem to be nearer *lineoventer* than to *topela* (Amoy). There is a good deal of individual variation to be seen in birds from Burma and no doubt the form here is an emotable intergrade which hardly merits recognition.]

[Anthus spinoletta coutellii. The Egyptian Water Pipit

Anthus spinoletta japonicus. The Japanese Water Pipit.

Alauda arvensis japonica. The Japanese Sky-Lark.

In the *F.B.I.* it is recorded that there is a specimen of *Anthus coutellii* from Burma in the British Museum. I have searched in vain for this specimen and from the distribution of this form it is exceedingly unlikely to occur in Burma. Under *japonicus* it is recorded in the *F.B.I.* that Oates identified two birds trapped in their nests on Mount Victoria as being of this race, and that the skins cannot now be traced. Further, Burma is included in the winter range of this bird. I can find no evidence for that statement. There are no specimens of *japonicus* from Burma in the British Museum.

Under *Alauda arvensis japonica* Oates is credited with having identified a bird of this form which had been shot off its nest on Mount Victoria. This specimen Mr. Baker considered to be *coelivox*.

It will be observed that Oates is said to have identified breeding birds of *Anthus japonicus* and of *Alauda japonica* from Mount Victoria. I feel quite sure that a muddle has occurred; the specimens of *Anthus japonicus* are not forthcoming, but in the British Museum there are two specimens of an *Alauda* taken by Col. Rippon on Mount Victoria on 19-4-04 and 25-3-04 which he identified as *arvensis*. On the labels *arvensis* was scratched out and *japonicus* inserted by Oates. I believe these specimens to have done duty for the records of both species.

[These skylarks from Mount Victoria I certainly think are not *japonica*, nor *coelivox*, but are *Alauda gulgula weigoldi* which occurs in Szechwan, S.-E. Tibet and N. Yunnan. It is more rusty and darker than *coelivox*.]

Anthreptes macularia macularia (1288). The Banded Sunbird.

One specimen in January 1936 from Simaw Reserve, Bhamo Forest Division. The bird was shot on the bank of a stream in thick evergreen jungle. The distribution is given in the *F.B.I.* as 'Western Burma from Akyab to Tenasserim'; but this record and also one of H. C. Smith from the Maymyo Forest Division shows that it occurs in North Eastern Burma.

[This is the bird at one time known as *Anthreptes hypogrammica* and *A. nuchalis*. Though the distribution in the *F.B.I.* is as given above it does not seem to be based on records or specimens. In the British Museum there are a few specimens from South Tenasserim only and I cannot find that it has been recorded by anyone since Oates wrote the *Birds of British Burma*; these two specimens form a notable extension of range. They match well with birds from Malay Peninsula whence came the type of *macularia* of which *nuchalis* is a synonym; the Sumatran and Bornean form is *hypogrammica*.]

Piprisoma agile modestum. The Thick-billed Flowerpecker.

Two from Thogale, S. Toungoo in March and April.

(The distribution given in the *F.B.I.* 'hilly country of Burma to Tenasserim, Shan States' is, so far as recorded specimens go, too sweeping. They show that this bird occurs in Pegu and Southern Shan States and throughout Tenasserim, and there are no records or specimens from elsewhere in Burma.)

Serilophus rubropygius. (1334). Hodgson's Broadbill.

Three specimens from Nanhlaing Reserve, Shwebo Forest Division and one specimen from Hkaungton Reserve, Kaukkwe river, Bhamo Forest Division are referred by Dr. Ticehurst to this species, which, according to the *F.B.I.* does not occur in Burma. They were shot in evergreen forest in the foothills, the Shwebo birds in August and the Bhamo bird in January.

(The distribution of the two species *Serilophus rubropygius* and *lunatus*, are not fully known. *Rubropygius* extends from Nepal, Sikkim, Bhutan to Manipur and Eastern Assam. It has been recorded in Arakan in Kyaukpandaung and in the Chin Hills. It occurs in the Myitkyina district and we now have it on the Kaukkwe river and in Shwebo Forest Division, both localities west of the Irrawaddy.

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Lunatus has a more southerly distribution from Tavoy north through Tenasserim to the Pegu Yomas, Karen Hills, Karenni, E. Shan States as far north as Mann State and the border of N. Hsenwi and Yunnan. Mr. Garthwaite has now extended the range to Hkaungton R.F., Bhamo Division on the west side of the Irrawaddy. It has been recorded in the Chin Hills otherwise the ranges do not overlap, but as they appeared very near to each other in Bhamo and I have seen no sign of intergradation I regard them as representative species.

The juvenile of *rubropygius* obtained by Mr. Garthwaite is like the adult but the chestnut of the rump extends farther up on to the mantle and the grey of the head and hind neck is faintly washed with this colour also; underparts not so pure a grey; greater wing coverts tipped with white; the silvery white marks of the female on the side of the neck are indicated but they are not so broad and clear.

I can see no evidence of moult of wings and tail at the post-juvenile moult, but the greater wing coverts must be moulted as no winter birds have these with white tips.)

Picus xanthopygaeus (1339). The Little Scaly-bellied Green Woodpecker.

One specimen from Gangaw; one from Kywetnapa, Maymyo; and one from Gada, Shwebo. The distribution in the *F.B.I.* is given as the Chin Hills.

[I have already pointed out that this bird is far more widely distributed in Burma (*J.B.N.H.S.*, xxxvi, 932). Mr. Garthwaite has now provided three further districts.

In *viridanus* the mandibular streak is black with white tips, in *xanthopygaeus* it is dark olive with whitish tips and therefore is not so conspicuous; in *viridanus* the dark markings on the underparts are heavier and there is a pronounced ochraceous wash on the breast. In addition the lateral under-tail coverts are *dark with narrow whitish bars* or horse shoe marks, whereas in *xanthophygaeus* these feathers are whitish with narrow dark bars or horse shoes.]

Picus erythropygius nigrigenis (1352). The Red-rumped Green Woodpecker.

One specimen shot in the Baw Reserve, 500 ft. in the Maymyo Forest Division. The jungle here is of the moist type at the foot of the very steep, hot dry slopes, rising up to the Shan plateau. This Woodpecker was one of a pack of three or four of the same species, which was also observed on other occasions in the same locality. They kept to the higher trees, and were not seen near the ground.

The distribution of this bird in the *F.B.I.* is given as 'Karenni and South Toungoo to Tenasserim' so that this record extends the known range considerably.

[The habit of going about in flocks was noted many years ago by Wardlaw-Ramsay.]

Gecinulus grantia grantia (1356). The Pale-headed Woodpecker.

Three specimens of this bird were obtained from the Nanhlaing Reserve, Shwebo Forest Division, two from Pile Reserve, West Katha Forest Division, and one from the Namma Reserve, Bhamo Forest Division. The *F.B.I.* records the occurrence only in the Chin Hills in Burma, but it is evidently common in the foothills of North Eastern Burma.

(Previously recorded outside the Chin Hills by Harington at Bhamo and by Mr. Stanford in the lower hills north of Myitkyina.)

Miglyptes jugularis (1387). The Black and Buff Woodpecker.

One specimen of this rare Woodpecker was obtained in March at Thogale, South Toungoo Forest Division.

Hemicircus canente canente. The Heart-spotted Woodpecker.

Specimens from Kaing R. F., Pyinmana; Gwethe, N. Toungoo.

[Though the *F.B.I.* gives the distribution as through Burma to Malay etc., I can find no evidence that it occurs in Burma north of 20° N. All the records and specimens in the British Museum come from the Arakan Yomas to Pyinmana and South through Toungoo, Pegu, Bassein and Tenasserim (where it must be a very common bird). It appears, however, to be much commoner on the east side of Burma than the west.]

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Vivia innominata malayorum. The Malay Speckled Piculet.

Specimens from Maymyo, Pile, Katha; Chaungzon, Shwebo, Namma R. F. Bhamo.

(This Piculet is evidently more widespread than has hitherto been recorded. The distribution in Burma so far as known is N. Tenasserim; Karen Hills, Loi Long and Na Noi in the S. Shan States; Shwebo, Katha, Maymyo and Bhamo Forest Division and Myitkyina District.)

Cyanops asiatica asiatica. The Blue-throat Barbet.

Specimens from Maymyo, Katha, Shwebo, Pyinmana, Toungoo Divisions.

[As explained in the *F.B.I.* some birds from Eastern Burma are intermediate between *asiatica* and *davisoni*.

Birds from Arakan, Chindwin, N. Burma and the western part of the Shan States are *asiatica;* from Pegu, Toungoo and the Karen Hills most are *asiatica* but in some there is a tendency towards *davisoni* in that the band on the crown instead of being black is black mixed with blue; from N. Tenasserim all have the band blue (not black as stated in the *F.B.I.*, iv, p. 118) and are *davisoni*.]

Harpactes oreskios uniformis (1588). Robinson's Yellow-breasted Trogon.

Two specimens from Thogale, South Toungoo Division.

One specimen from Gwethe Reserve, North Toungoo Division.

One specimen from Kaing Reserve, Pyinmana Forest Division.

This bird is recorded in the *F.B.I.* as occurring in Tenasserim only: these records, therefore, extend its northward range greatly. Young birds were seen in the Thogale locality in June, so that it is likely that the bird breeds there.

(Blyth and others have recorded this bird from Arakan, Oates from Pegu, Ramsay from the Karen Hills, Dr. Schanensei from Kengtung State, S. Shan States.)

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THE MEDICINAL AND POISONOUS CAMPIONS OF INDIA.

BY

J. F. CAIUS, S.J., F.L.S.

The CARYOPHYLLACEAE are herbs, rarely undershrubs. They mostly inhabit the extra-tropical regions of the northern hemisphere, extending to the Arctic regions and to the tops of the highest Alps. They are rarer in the southern hemisphere, and still more so in the tropics, where they are almost confined to the mountains. They form 80 genera with about 1,300 cosmopolitan species.

The medicinal and poisonous campions and pinks of the world belong to 23 genera:—AGROSTEMMA (Mediterranean region); ALSINE (northern hemisphere); ARENARIA (northern temperate regions); BUFONIA (Mediterranean region); CERASTIUM (northern temperate regions); CUCUBALUS (northern temperate regions); DIANTHUS (Europe, Asia, Africa; mostly Mediterranean); DRYMARIA (tropical and southern temperate regions); GYPSOPHILA (Europe, Asia; especially eastern Mediterranean); HERNIARIA (Mediterranean; Europe, South Africa); HOLOSTEUM (northern temperate regions); LYCHNIS (northern temperate regions); MELANDRIUM (northern hemisphere; South Africa, South America); POLLICHIA (tropical and South Africa); POLYCARPAEA (cosmopolitan); POLYCARPON (cosmopolitan); SAGINA (northern temperate regions); SAPONARIA (northern temperate regions, chiefly Mediterranean); SILENE (northern temperate regions, chiefly Mediterranean); SPERGULA (temperate regions); SPERGULARIA (cosmopolitan); STELLARIA (cosmopolitan); TISSA (cosmopolitan).

The medicinal and poisonous campions of India belong to 13 genera:—ARENARIA, CERASTIUM, CUCUBALUS, DIANTHUS, DRYMARIA, HOLOSTEUM, LYCHNIS, POLYCARPAEA, POLYCARPON, SAPONARIA, SILENE, SPERGULA, STELLARIA.

A. Calyx gamosepalous, 4-5 lobed. Petals clawed and stamens inserted on an elongate gynophore (rarely sessible). Styles free. Stipules absent.

I. Capsule dehiscent; styles 2. Seeds pelate; hilum facial; embryo straight.
Calyx bracteate, striate ... ... DIANTHUS.

II. Capsule bursting by short or long valves. Hilum lateral; embryo annular.

1. Calyx veined. Capsule shortly 4-valved; styles 2 ... ... SAPONARIA.
2. Calyx 10-∞-nerved. Capsule partially celled, shortly 3-6-valved; styles 3 ... SILENE.
3. Calyx 10-nerved. Fruit fleshy; styles 3 ... CUCUBALUS.
4. Calyx 10-nerved. Capsule shortly 4-5- or 8-10-valved; styles 5. ... ... LYCHNIS.

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B. Sepals free, or connate at the base only. Petals subsessile and stamens inserted on an annular disk, rarely perigynous. Styles free.

I. Stipules absent. Sepals free. Stamens hypogynous.

1. Petals jagged. Capsule cylindric or conic, 6-valved. Styles 3. Seeds many, compressed ... ... HOLOSTEUM.

2. Petals notched or entire. Capsule cylindric or conic, 8-10-valved. Styles 3-5, opposite the sepals. Seeds many ... ... CERASTIUM.

3. Petals bifid. Capsule globose ovoid or oblong. Styles 3-5. Seeds few or many. STELLARIA.

4. Petals entire or lacerate. Capsule globose ovoid or oblong. Styles usually 2-3. Seeds many ... ... ARENARIA.

II. Stipules scarious. Sepals free. Petals entire. Styles 3 or 5. Capsules 3- or 5-valved ... ... SPERGULA.

C. Sepals free. Petals subsessile and stamens inserted on an annular disk. Styles 2-3, combined. Stipules scarious, rarely obsolete.

I. Sepals not keeled. Petals 2-6-fid. ... ... DRYMARIA.

II. Sepals keeled. Petals entire. Style 3-fid ... ... POLYCARPON.

III. Sepals scarious, not keeled. Stigma 3-toothed ... POLYCARPAEA.

ARENARIA.

The genus consists of about 100 species, all natives of cold and temperate regions.

Arenaria serpyllifolia Linn. is found in the subtropical and temperate Himalaya from Nepal to Kashmir, in Rohilkhand and the Punjab at 10,000-11,000 ft., in Western Tibet at 11,000-13,000 ft. It extends to Afghanistan, temperate Europe and Asia.

The herb has long been used in China for bladder diseases. It is considered very valuable for calculus troubles and acute and chronic cystitis.

Chinese: Li Ke Ts'ao—*English*: Lloyd's Sandwort, Sandwort, Thyme-leaved Sandwort—.

CERASTIUM.

The genus numbers about 100 species, all natives of temperate and cold regions.

C. arvense Linn. is used medicinally in Europe.

Cerastium vulgatum Linn. occurs throughout the temperate and subalpine regions of India and Ceylon, ascending to 15,000 ft. in Sikkim and Western Tibet. It extends to temperate Northern Europe and Asia.

The plant is used in Spain as a mild refrigerant.

English: Chickenweed, Mouse-ear, Mouse-ear Chickweed, Murion—.

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CUCUBALUS.

The one species of this genus. **C. bacciferus** Linn., occurs in the temperate Himalaya from Kashmir at 5,000-8,000 ft. to Sikkim at 8,000-12,000 ft.; in the Khasia Hills, at the Boya Pani at 5,000 ft. It is distributed westwards to South Europe, to Central Asia and to West Siberia.

A decoction of the herb is used in Spain to check haemorrhage.

English: Berry-bearing Campion, Bladder Campion—; *French*: Behen baccifère, Coulichon—; *Spanish*: Oreja de vecino, Pamphlina de bayas, Purga cabras—.

DIANTHUS.

The genus includes about 250 species, natives of the northern temperate zone exclusive of Western North America; one of Siberia extending into Arctic America.

D. armeria Linn., *D. barbatus* Linn., *D. carthusianorum* Linn., *D. caryophyllus* Linn., *D. plumarius, D. sylvestris* Wulf. are used medicinally in Europe; *D. superbus* Linn. in China; *D. crenatus* Thunb., *D. scaber* Thunb. in South Africa.

1. Leaves very narrow, rigid, slender, mid-rib very thick, margin much thickened, finely toothed ... *D. anatolicus.*
2. Leaves channelled above, bent-back, with smooth margins, linear ... ... *D. caryophyllus.*
3. Leaves broad and nearly flat or slightly trough-shaped, 3-5-nerved ... ... *D. chinensis.*

1. **Dianthus anatolicus** Boiss. is found in the Western Himalaya, Western Tibet, Kashmir, and extends to Armenia.

It is used as an antiperiodic in intermittent fevers.

Persian: Kantariyun—.

2. **Dianthus caryophyllus** Linn. is generally supposed to be a native of the Mediterranean. It occurs in Baltistan, the Punjab and Kashmir at 7,000-8,000 ft., extending westwards to Europe.

The flowers are used medicinally in Spain and North America; they are considered cardiotonic, diaphoretic and alexiteric. They are nervine and antispasmodic.

The whole plant is used as a vermifuge in China.

Annam: Cu mach—; *Catalan*: Clavellina—; *English*: Carnation Pink, Clove Pink, Wild Carnation—; *French*: Œillet commun, Œillet des fleuristes, Œilllet giroflée Œillet des jardins, Œillet à ratafia—; *Roumanian*: Garoafa—; *Russian*: Gvasdika—; *Spanish*: Clavelina comun—.

3. **Dianthus chinensis** Linn. is a native of China and Japan cultivated in Indian gardens.

A broth of the fresh new leaves is given in infantile diarrhoea. The old dried leaves are pounded and used in diseases of the eye to clear the eyesight.

The dried flowering plants are used in China as a diuretic, anthelmintic, and abortifacient.

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In Indo-China the dried flowers and buds are given as a diuretic for indigestion and in difficult labour; they are also prescribed in kidney troubles.

In Malaya the herb is used as a remedy for gonorrhoea.

English: China Pink—; *French*: Œillet de Chine, Œillet de la régence, Œillet rouge—; *Indo-China*: Thach truc, Truc tu hoa—; *Portuguese*: Cravina—.

Drymaria.

The genus includes about 40 species; one in tropical Asia and Africa, one in Australia, the rest in America.

D. cordata Willd. and *D. glandulosa* Bartl. are used as cooling medicines in French Guiana.

Drymaria cordata Willd. is found in tropical and sub-tropical India and Ceylon, extending westwards to the Punjab and ascending the Himalaya to 7,000 ft. in Sikkim. It occurs in the Malay Peninsula, Java, Sumatra, Papua, tropical Africa and America.

In French Guiana it is eaten as a salad for its cooling properties.

French Guiana: Mignonnette—.

Holosteum.

The genus consists of 6 species inhabiting the northern temperate regions.

Holosteum umbellatum Linn. is found in Kashmir, and in cultivated fields in the Quetta valley; it extends to western Asia, North Africa and Europe.

It is reputed to have refreshing and slightly demulcent properties.

English: Umbellate Chickweed—.

Lychnis.

The genus is made up of 10 species, natives of Arctic and Temperate northern regions, and of the Andes of South America.

The following are used medicinally in Europe—*L. chalcedonica* Linn., *L. coronaria* Desr., *L. dioica* Linn., L. *flos-cuculi* Linn., *L. githago* Lam.—; in China—*L. grandiflora* Jacq.—; in Indo-China—*L. fulgens* Fisch., *L. Senno* Sieb. and Zucc.—; in South Africa—*L. githago* Lam.—; in North America—*L. alba* Mill.—.

Lychnis coronaria Desr. is abundant in Kashmir: Gadsar, roadsides and dry places; near Shirazia Bagh, on top of hill in rocky and grassy soil; Dachigan Rukh; below Gulmarg, wooded hill-side at 8,000 ft. It extends to West Asia and South Europe.

An extract or a decoction of the root is used in Spain for infraction of the lymph glands of the mesentery, and for diseases of the lungs and the liver.

Catalan: Pessiganassos—; *French*: Coquelourde—; *Spanish*: Candelaria, Claveles lanudos, Coronaria purpurea, Guantes de reina, Rosa de Grecia—.

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POLYCARPAEA.

This genus consists of 30 cosmopolitan species.

P. arenaria Gagnep. is used medicinally in Indo-China, *P. corymbosa* Lam. in Malaya and Transvaal, *P. linearifolia* DC. in Nigeria.

Polycarpaea corymbosa Lam. is a cosmopolitan herb. It is found in the Western Peninsula and Ceylon, Central and North-Western India, Sind, ascending the Western Himalaya to 7,000 ft.; it also occurs in Burma and the Malay Peninsula.

The herb is useful in strangury, urinary calculi, boils, inflammatory swellings, and ulcers. Its ash mixed with pepper is applied externally to boils and ulcers (Ayurveda).

The pounded leaves are used as poultice, warm or cold, over boils and inflammatory swellings.

In Pudukotah the herb is administered both externally and internally as a remedy for the bites of venomous reptiles. In Porebunder the pounded leaves are used for bites from animals, and given with molasses in the form of a pill in jaundice.

In Malaya the drug is found in the shops as flowering heads, arising from silvery cymes, with portions of the stem and tomentose leaves, and is used as a demulcent and astringent.

Whether administered internally or applied externally the herb is useless in the treatment of snake-bite (Mhaskar and Caius).

Chinese: Pai T'ou Weng—; *Hausa*: Bakin suda—; *Malaya*: Pak thow yoong—; *Porebunder*: Okharad—; *Rajputana*: Zutaniakhand—; *Sanskrit*: Bhisatta, Okharadi, Tadagamritikodbhava—; *Santal*: Janhenanjur—; *Tamil*: Nilaisedachi—; *Telugu*: Bommasari, Rajuma—.

POLYCARPON.

A small genus of 7 species, distributed throughout all the warm and temperate climates of the world.

Polycarpon indicum Merrill is found in the hotter parts of India in fields and waste places; in Indo-China and tropical Africa.

In Indo-China an infusion of the roasted leaves is given for cough following upon a fever, more particularly measles.

Indo-China: La coc man—.

SAPONARIA.

The genus includes 20 species, chiefly Mediterranean and Western Asiatic.

The following are used medicinally in Europe—*S. ocymoides* Linn., *S. officinalis* Linn., *S. Vaccaria* Linn.—; in China and Indo-China—*S. Vaccaria* Linn.—; on the Pacific Coast: *S. officinalis* Linn.

The root of *S. officinalis* Linn. is official in France. A toxic glucoside, saporubin, has been extracted from it.

Saponaria Vaccaria Linn. is a cosmopolitan weed of cultivation found throughout India.

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The Yunani practitioners use the plant for enlargement of the spleen, dysmenorrhoea, and ulcers; the leaves are commonly given for scabies and itch.

The mucilaginous sap of the plant is considered to have febrifuge and tonic properties in long continued fevers of a low type.

In Indo-China the plant is used as a mild depurative. In China it is used in furunculosis and scabies.

The leaves and roots contain from 8 to 15 per cent of saponin.

The seeds contain a sapotoxin, and are somewhat toxic to stock.

Arabic: Gafis, Gleylé—; *Bengal*: Sabuni—; *Brahui*: Karari—; *Chinese*: Wang Pu Liu Hsing—; *Egypt*: Ful-el-'arab—; *English*: Cockle, Cow Basil—; *French*: Blé de vache, Copatte, Saponaire à vaches, Saponaire des vaches—; *German*: Wilder Weid, Kuhkraut—; *Hindi*: Musna—; *Hova*: Savonimbary—; *Indo-China*: Vuong bat luu hanh—; *Iraq*: Kharaz bint-al-fallah, Ziwan—; *Italian*: Cetino, Mezzettino—; *Malta*: Cow Basil, Cow-herb, Cetino, Mazzettino—; *Mosul*: Ziwan—; *Persian*: Gafis, Guligafis—; *Santali*: Musna—; *Sind*: Musna—; *South Africa*: China Cockle, Cockle, Cow basil, Cow foot, Glond, Soapwort, Spring cockle—; *Spanish*: Teta de vaca—; *Uriya*: Tilothi—.

Silene.

A genus of 320 species, natives of temperate Europe and Asia, chiefly Mediterranean.

The following are used medicinally in Europe—*S. apetala* Willd., *S. cerastoides* Linn., *S. conoidea* Linn., *S. Cucubalus* Wibel, *S. gallica* Linn., *S. hirsuta* Lag., *S. inaperta* Linn., *S. italica* Pers., *S. nicaeensis* All., *S. nocturna* Linn., *S. nutans* Linn., *S. otites* Sm., *S. rupestris* Linn., *S. saxifraga* Linn., *S. viscosa* Pers.—; in Indo-China—*S. macrosolen* Steud.—; in South Africa—*S. Burchellii* Otth.; *S. capensis* Otth.—; in North America—*S. laciniata* Cav, *S. noctiflora* Linn., *S. stellata* Ait., *S. virginica* Linn.

A. Perennial.
  Petals imbricate in bud. Calyx inflated, 20-nerved, reticulately veined ... ... *S. Cucubalus.*

B. Annuals.
  Petals contorted in aestivation. Calyx not reticulately veined.
  I. Calyx 20-, 30-, or 60-nerved, in fruit conical from a broad base. Petals pink ... ... *S. conoidea.*
  II. Calyx 10-nerved. Flowers in unilateral racemes.
    1. Face of the seeds smooth, rather concave, back deeply grooved with two wavy wings. Petals absent or minute, bright red ... ... *S. apetala.*
    2. Face of the seeds flat with an ear-shaped depression, back not grooved. Petals red or white ... ... *S. gallica.*

1. **Silene Cucubalus** Wibel is found in the temperate Himalaya at 5,000-11,500 ft., from Nepal to the Indus. It is distributed over temperate Asia, Europe and North Africa.

In Spain the plant is considered emollient, and it is used in baths or as a fumigant; the juice is prescribed in ophthalmia.

Baleares: Trons—; *Catalan*: Botets, Colitxos, Culissos, Cuniells, Curibells, Esclafidors—; *English*: Bladder Campion, Inflated Catchfly, White Ben, White

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Bottle—; *French*: Behen blanc, Behen commun—; *German*: Klatschnelke, Leimkraut, Schaummohn—; *Italian*: Behen bianco, Bubbolini, Crepa terra—; *Maltese*: Kaskeiza—; *Spanish*: Alcanducea, Cascabelillo de Canarias, Collejas, Conejera, Polemonio pratense—.

2. **Silene conoidea** Linn. occurs in Kashmir and Baluchistan; from Kumaon to the Indus and from Oudh to the Punjab; in West Tibet at Ladakh. It extends westwards to the Atlantic Ocean.

The plant is used therapeutically in Spain as a substitute for *S. Cucubalus*.

Harboi Hills: Dardiri—; *Kalat*: Gardi—; *Kharan*: Guto—; *Spanish*: Claveletas de barranco—.

3. **Silene apetala** Willd. is found in Peshawar; it extends through Afghanistan and Persia to South Europe and North Africa.

In Spain the juice is used in eye troubles; the plant is used in baths or as a fomentation for its emollient properties.

4. **Silena gallica** Linn. is found in Garhwal and in the Carnatic; it is common everywhere in the Mediterranean region.

The plant is used in Spain as a substitute for *S. Cucubalus*.

Spanish: Carmentilla—.

SPERGULA.

A very small genus of 3 European and Asiatic species.

Spergula arvensis Linn. is found in cultivated fields in various cool parts of India and throughout the northern hemisphere.

It is used as a diuretic in Colombia.

Bogotá: Abrojito—; *Dutch*: Spurrie—; *English*: Beggar-weed, Bottle Brush, Cowquake, Dodder, Dother, Farmer's Ruin, Franke, Granyagh, Lousy Grass, Make-beggar, Mountain Flax, Pick Pocket, Pick Purse, Poverty Weed, Sandweed, Spurrey, Spurry, Toad Flax, Yarr, Yarrel, Yawr, Yur—; *French*: Espargoule, Espargoute, Espargoutte, Spargoule, Spargoute, Spergoute, Spergule, Sperjule—; *German*: Spergel—; *Roumanian*: Granat—; *Russian*: Taritsa—; *Spanish*: Espergula—.

STELLARIA.

A genus of about 100 species, dispersed over the whole world, but most abundant in cold and temperate regions.

A. Annual.
  Sepals free to the base. Petals shorter than the calyx or absent. Stamens 3-10, hypogynous. Styles 3. Capsule with 4-6 entire valves ... ... *S. media.*

B. Perennials.
  I. Sepals free to the base. Petals with diverging lobes. Stamens hypogynous. Styles 5. Capsule with 5 bifid valves ... ... *S. aquatica.*

  II. Sepals more or less connate at the base into an obconic tube. Petals minute or absent. Stamens 10, perigynous. Styles 3. Capsule with 6 entire valves ... ... *S. uliginosa.*

1. **Stellaria media** Linn. is found in cultivated and waste places, roadsides and edges of streams throughout the Punjab and temperate regions of India, ascending in the Himalya to 12,000 ft.

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and in Western Tibet to 14,500 ft.; in the Mediterranean basin, throughout Europe and northern Asia, and carried out as a weed to all the temperate and colder regions of the globe.

The plant is employed in plaster for broken bones and swellings, as it is supposed to be binding and cooling.

The herb is used in Spain as a vulnerary, astringent and resolvent. On the Pacific Coast it is reputed refrigerant, demulcent and alterative.

Catalan: Burrissol, Murrons, Murrons blanchs, Murrons de canari, Picagallina, Picapoll—; *Dutch*: Muur—; *Egypt*: Gezāze—; *English*: Chickweed, Common chickweed—; *French*: Alsiné, Alsiné des oiseaux, Mouron blanc, Mouron des oiseaux, Mouron d'hiver, Morsgeline, Morsgeline—; *German*: Augentrostgras—; *Italian*: Budellina, Centonchio, Centoncolo, Morgellina, Paperina—; *Malta*: Common Chickweed, Budellina, Centocchio, Paperina, Harira bajda—; *Pacific Coast*: Alsine, Chickenweed, Common Chickweed, Satin-flower, Tongue-grass, White-bird, Winter-weed—; *Roumanian*: Limba vrabiei—; *Russian*: Makritsa—; *Spanish*: Pamplina, Pamplina de canarios, Pajarera, Yerba gallina, Yerba pajarera—.

2. **Stellaria aquatica** Scop. occurs in the temperate Himalaya from Nepal to Marri, at 4,000-8,000 ft. It extends to Northern and Western Asia, Europe, and North Africa.

In Indo-China a decoction of the leaves is given as a galactagogue to nursing mothers suffering from want of milk.

In China the plant is used for the treatment of fistulae.

Chinese: Fan Lu—; *English*: Chickweed, Great Chickweed, Water Chickweed—; *French*: Stellaire aquatique—; *Indo-China*: Phon lau—; *Malta*; Water Starwort, Budellina d' acqua—.

3. **Stellaria uliginosa** Murr. is found in wet places of the temperate and alpine regions at 4,000-10,000 ft.; in the temperate and alpine Himalaya from Kashmir to Sikkim, here up to 16,000 ft.; in the Khasia Hills at 5,000-6,000 ft. It is generally distributed over the temperate regions of the northern hemisphere.

A decoction of the leaves is used as a galactagogue in Indo-China.

English: Bog Stitchwort—; *Indo-China*: Tuoc thiet thao—.

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THE ORNITHOLOGY OF TRAVANCORE AND COCHIN.

BY

SÁLIM ALI.

With Notes by HUGH WHISTLER.

PART VIII.

(*Concluded from page 342 of this volume*).

ORDER: PTEROCLETES.

FAMILY: PTEROCLIDÆ.

[**Pterocles exustus ehioti** Bogdanow. The Common Indian Sandgrouse.

Not met with by the Surveys, neither recorded from Travancore by Bourdillon or Ferguson.

In the *Fauna* (v, 272) as well as *Nidification* (v, 185) it is stated that the Common Sandgrouse is found 'in the open parts of Travancore'. Mr. Stuart Baker further writes (*Game Birds of India*, ii, 297) that he has received its eggs from Travancore. The dry low country about Cape Comorin and Arāmboli, where the Ring Dove and the Little Brown Dove were found, certainly appears suited to the requirements of this species, but a confirmation of its occurrence and breeding in Travancore is nevertheless desirable.]

ORDER: GALLINÆ.

SUB-ORDER: ALECTOROPODES.

FAMILY: PHASIANIDÆ.

SUB-FAMILY: PAVONINÆ.

Pavo cristatus Linnaeus. The Common Peafowl.

Not met with by the Surveys.

According to Ferguson (*J.B.N.H.S.*, xvi, 3) the Peafowl was at one time common at the foot of the hills in South Travancore, though no longer so at the time of his writing (1904). He also came across it in the hills about Peermade.

I was informed by the Forest Range Officer of Wadakkāncheri that 4 or 5 years previously he had shot peafowl at a place called Mylātampāra (meaning 'Peacock-dancing rock') in Cochin, near Mulloorkara Railway Station, and that there were some still to be found in this locality. The species, however, seems at present to be very rare in a wild state in Travancore and Cochin.

In the Palni Hills, Fairbank (*S.F.*, v, 409) observed it at the northern base. He wrote this as long ago as 1868 or thereabouts, and no more recent information is available.

Breeding: There is nothing recorded concerning our area.

SUB-FAMILY: PHASIANINÆ.

Gallus sonneratii Temminck. The Grey Jungle Fowl.

Specimen collected: 491 ♂ 26-3-33 Tenmalai 500 ft.

Elsewhere noted and/or shot at: Marāiyūr (3,500 ft.); Sānthanpāra (3,500 ft.); Thattakād (200 ft.); Peermade (3,200 ft.); Rājampāra (1,350 ft.); Tenmalai (500 ft.); Kūriārkutti (1,600 ft.); Wadakkāncheri (400 ft.); Pādagiri (3,000 ft.).

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Colours of bare parts: *Adult* ♂. Iris dusky chrome yellow; bill yellowish flesh colour, dark horny brown on culmen; comb and wattles bright crimson; legs and feet yellowish and pale magenta; claws horny brown; spurs darker brown.

[Measurements:

	Bill.	Wing.	Tail.	Tarsus.
4 ♂♂	33-5-35	223-243	314-375	69-73-5 mm.
4 ♀♀	32-33	187-201	99-115	60-63 mm.

I have seen 8 additional Travancore specimens, but none have any proper data.—H. W.]

The Grey Jungle-fowl is very common in the forested tracts of Travancore and Cochin, both hill and plain. It was noted as most abundant in the foothills country, but was also met with up to an elevation of about 4,500 ft. About Thattakād, with its secondary scrub jungle and mixed deciduous and evergreen forest, with abandoned overgrown rubber plantations here and there and scattered toungya clearings and cultivation, these birds seemed to have struck optimum conditions and were, indeed, more numerous than I have ever seen them elsewhere in India. The crowing of the cocks was to be heard on every side, chiefly in the mornings and evenings. Here the cocks usually had one bout of interim all-round crowing every morning between 2 and 3.30 a.m. when it was still pitch dark. Cocks from far and near vied in answering one another. After this there was silence again for two hours or so until it was light enough for the birds to bestir themselves. The crowing is usually, but not invariably, preceded by a loud flapping of the wings against their sides.

In the vicinity of the camp shed at Thattakād there was ploughing in progress in a fallow field, and parties of jungle-fowl were usually to be seen following the plough or feeding unconcernedly within a few yards of the small boy and his bullocks.

In the Nelliampathy Hills, jungle-fowl were mostly met with at the edge of tea and coffee plantations and in the secondary jungle surrounding them. Kinloch (*J.B.N.H.S.*, xxvii, 943) indeed found them very common everywhere in these hills, especially when the *Strobilanthes* and bamboos were in seed.

In the Palni Hills, Fairbank (*S.F.*, v. 400) observed this jungle-fowl at 5,000 ft. elevation, but owing to being much hunted it was already, in his time, rare on the hills. Terry (*S.F.*, x, 479) observed a few in the large sholas, but found it commoner in the thick scrub jungle on the lower slopes and in valleys. This was the case 50 to 60 years ago and as its persecution had already then commenced, it would be interesting to learn of its present status.

It does not occur in Ceylon.

Breeding: The testes of the specimen (26 March) measured 20×11 mm. and the bird was undoubtedly breeding. On 3 February (Thattakād) a brood of 4-5 chicks, apparently about 6 weeks old, were observed with their mother.

According to Ferguson (*J.B.N.H.S.*, xvi, 3) the breeding season in South Travancore is February and March. Stewart and Bourdillon (*Nidification*, iv, 200) took eggs in Travancore between March and July; in the Nelliampathy Hills Kinloch found eggs from February to October.

From the evidence it appears that there is no hard and fast breeding season in Travancore and Cochin, and it perhaps varies with local conditions. The greater part of the breeding, however, certainly takes place between February and July. The normal clutch is said to consist of 3-5 eggs. Ferguson once found a nest containing seven.

Sub-Family: Perdicinæ.

Galloperdix spadicea stewarti Stuart Baker. The Travancore Red Spur-fowl.

Specimens collected: 376 ♂ 28-2-33 Kūmili 3,000 ft.; 479 ♂, 480 ♀ juv., 21-3-33 Rājampāra 1,350 ft.; 658 ♂, 25-4-33 near Mūthūkūzhi, 3,500 ft.—Ashāmbū Hills.

Elsewhere noted and/or shot at: Marāiyūr (3,500 ft.); Thattakād (200 ft.); Perivār Lake Environs (ca. 3,000 ft.); Tenmalai (500 ft.); Arāmboli (250 ft.); Kūriārkūtti (1,600 ft.); Wadakkāncheri (400 ft.); Pādagiri (3,000 ft.).

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Colours of bare parts: *Adult*: Iris yellowish-brown or orange-brown; bill basal half bright pink, terminal half pale horny brown; orbital skin bright rose pink; legs and feet salmon pink or orange-coral; mouth pink; claws and spurs pale horny brown. *Juvenile* (No. 480) Iris olive brown; rest as in adult, but much paler everywhere.

[Additional specimens examined:

Brit. Mus. Coll.: ♂ 21-2-14, ♂ imm. 23-2-14, ♂♂ -7-19, ♀ -8-19 Aneichardi (Stewart). Also some Fry specimens without proper data.)

Measurements:

	Bill.	Wing.	Tail.	Tarsus.
6 adult ♂♂	22-25·5	153-164	116-136	49-55 mm.
1 ♀	20	148	118	... mm.

The male evidently assumes adult plumage at the post-juvenal moult. H. W.]

The Spur-fowl is a cmomon resident species in Travancore and Cochin, principally in the foothills country where clothed with deciduous and mixed scrub or secondary jungle, but also at higher elevations—up to 3,500 feet at least—in suitable facies. It has a preference for dry scrub-covered hillsides with rocky outcrops and the ravines at their base. Pairs and family parties of 3 to 6 birds were usually met with. Often when suddenly come upon it flies up into the branches of overhanging or nearby trees.

Kinloch (*J.B.N.H.S.*, xxvii, 943) describes the Spur-fowl as very common everywhere in the Nelliampathy Hills. In the Palnis, Fairbank (*S.F.*, v, 409) saw only one, but Terry (*S.F.*, x, 479) found it common at Pittur. No specimens from Cochin or the Palni Hills are available for examination however, hence the subspecies is only probable.

It is not found in Ceylon.

Breeding: The adult specimens collected by the Survey showed no gonadal development, but No. 480 (21 March) was a young bird—one of a brood of 2 or 3 accompanied by parents—undergoing complete post-juvenal moult. On 17 April (Arāmboli) an adult accompanied by at least 3 downy chicks was observed.

Nidification (iv, 228) states that Stewart and Bourdillon obtained many clutches of eggs of this Spur-fowl in Travancore at between 1 and 3 thousand feet elevation. The season is said to be irregular, from January to the end of March or early April, and a few birds are said to breed again in September and October.

Galloperdix lunulata Valenciennes. The Painted Spur-fowl.

No specimen procured, and not previously recorded from Travancore or Cochin.

At Arāmboli (21 April) I observed an adult accompanied by 4 (or 5?) half-grown chicks in sparse scrub and thorn country on the side of a boulder strewn hillock. As I had an unobstructed view of this family party through field glasses, I feel satisfied about the correctness of my identification.

Excalfactoria chinensis chinensis (Linn.). The Blue-breasted Quail.

Not met with by the Surveys.

According to Ferguson (*J.B.N.H.S.*, xvi, 4) this little quail occurs on the grasslands at Peermade. He believes that it breeds in Travancore although the evidence cited seems far from satisfactory. Stuart Baker (*Fauna*, v, 370) even calls it 'a common breeding bird in Travancore and the Malabar coast to Bombay . . .' On what authority this statement is based is not known, but I cannot think that it is wholly accurate.

Coturnix coturnix (Linnaeus). The Common or Grey Quail.

No specimen procured. A single bird, presumably this species, was flushed on a grassy hillside at Peermade, ca. 3,500 ft. elevation (22 February).

Ferguson's statement (*J.B.N.H.S.*, xvi, 4) that according to his information it is not uncommon on the grasslands at Peermade where it is known as the 'drummer', refers in all probability to the Bustard Quail. The Common Quail does not drum or 'purr' as far as I am aware to deserve this epithet.

No Travancore or Cochin specimens are available for racial attribution.

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Coturnix coromandelicus (Gmelin). The Black-breasted or Rain Quail.

Not met with by the Surveys, neither recorded by Ferguson and others from Travancore or Cochin. Mr. Whistler points out, however, (*J.B.N.H.S.*, xxxviii, 685) that there are 2 ♂♂ in the British Museum collected in Travancore, apparently near Trivandrum, by Surgeon-General Fry.

Perdicula asiatica subsp.? The Jungle Bush Quail.

Specimens not procured.

Noted at: Chālakūdi, Wadakkāncheri (400 ft.) in deciduous scrub-and-bush country.

Ferguson (*J.B.N.H.S.*, xvi, 4) says that the Bush-Quail is found about Cape Comorin but nowhere else in Travancore within his knowledge. The species must be rare since the Survey did not once come across it either in the locality named by him or about Arâmboli—another likely spot. The latter, moreover, adjoins the dry Madras district of Tinnevelly whence according to Ferguson numbers are brought alive to Trivandrum for sale.

The race *P. a. ceylonensis* Whistler occurs in Ceylon.

Breeding: 'In Travancore Stewart found them breeding from January to March, most eggs being laid in February' (*Nidification*, iv, 240). A full clutch is said to consist of from 4 to 8 eggs, most often 5 or 6.

Cryptoplectron erythrorhynchum (Sykes). The Painted Bush-Quail.

Specimens collected: 184 ♀, 185 ♂ 29-1-33 Sānthanpāra 3,500 ft.; 333 ♂ 22-2-33 Peermade 3,200 ft.

Elsewhere noted at: Kūmili and Periyār Lake Environs (ca 3,000 ft.).

Colours of bare parts: Iris yellowish-brown; bill coral pink, brownish at tip of both mandibles; legs and feet coral pink; claws dusky.

[Additional specimens seen:

Brit. Mus. Coll. ♀ -4-97 Devicolum, Travancore (Ferguson). Also some other Travancore specimens without data.

Sparrow Coll.: ♂ 27-3-14 Cardamom Hills.

Measurements:

	Bill.	Wing.	Tail.	Tarsus.
3 ♂♂	14.5-16	81-87	40-44	23-25 mm.
3 ♀♀	14.5-16.5	81.5-92.5	43.5-45	24.5 mm.—H. W.]

The Painted Bush-Quail is a common species on the hills of North Travancore. The Survey did not come across it below an elevation of about 2,500 ft., or south of about Kūmili. How much further south it extends is not known. Ferguson (*J.B.N.H.S.*, xvi, 4) records it only from the Cardamom Hills and the High Range. H. J. Elwes (*Ibis* 1870, pp. 526-28) records it as extremely abundant in the long grass on the Cardamom Hills. Kinloch (*J.B.N.H.S.*, xxix, 565) found it very common on the Lily Downs of the Cochin Nelliampathies at about 4,700 ft.

Coveys, usually of 6-10 birds, were commonly flushed among tall coarse grass on open hillsides, especially by the edge of sholas. In the mornings and evenings the birds came out into opener patches to feed, and were then frequently to be seen dusting themselves on paths etc. in suitable facies.

In the Palni Hills this Bush-Quail is fairly common in places, according to Terry (*S.F.*, x, 479); and Fairbank (*S.F.*, v, 409) obtained it in the Kodaikanal, ca 7,000 ft.

It does not occur in Ceylon.

Breeding: The gonads of the specimens were inactive. On 7 March a pair of adults accompanied by 4 or 5 chicks—about the size of a Munia, and able to fly—were flushed in secondary scrub and bamboo brushwood on the edge of Periyār Lake.

Nidification (iv, 243) mentions that in Travancore Bourdillon obtained eggs in January, February, July to September, and again in December, which suggests that the season is not well-defined. The normal clutch is said to be of 4-6 eggs.

Francolinus pondicerianus pondicerianus (Gmelin). The Southern Grey Partridge.

Specimen not obtained.

The Surveys only came across the Grey Partridge—in small numbers—in

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the dry, open scrub and cultivated country around Cape Comorin; nowhere else in Travancore or Cochin. Ferguson (*J.B.N.H.S.*, xvi, 4) also records it from this same area and says that it is not found elsewhere in Travancore.

In the Palni Hills, Fairbank (*S.F.*, v, 409) observed it at Periakulam. It occurs in the dry country in Ceylon.

Breeding: No specific information concerning its breeding in our area is available. According to the *Fauna* (v, 420) it apparently has two seasons in South India, one from February to May and the second August to October.

ORDER: HEMIPODII.

FAMILY: TURNICIDÆ.

Turnix suscitator [taigoor (Sykes)]. The Common Bustard Quail.

Specimen not obtained.

The Travancore Survey has only 2 records of the Bustard Quail: (1) Kūmili, 3,000 ft., 1-3-33—A pair in tall grass in deciduous country—Periyār Lake Environs, and (2) Arāmboli, 17-4-33—heard drumming. It was not met with in Cochin.

Ferguson (*J.B.N.H.S.*, xvi, 5) describes it as 'Not uncommon in scrub jungle in the low country' (of Travancore). This is a statement that I am unable to confirm. In my experience the species was definitely rare.

Mr. Whistler points out (*J.B.N.H.S.*, xxxviii, 689) that in the British Museum Collection there is a female collected by Nair on 15 February 1899 at Padmanabhapuram which cannot be distinguished from the Cinghalese race *T. s. leggei*. He mentions at the same time that there is great individual variation in these Bustard Quails and that only a collection of fresh material will enable the difficulty as regards races to be settled. Regarding the locality, Padmanabhapuram, Mr. N. G. Pillai informs me that there is a place of that name in South Travancore noted chiefly for an old palace with a remarkable series of mural paintings. The identity of the collector, Nair, however cannot be unearthed. He was apparently not a collector of the Trivandrum Museum.

[**Turnix sylvatica dussumieri** (Temm. and Lang). The Little Button Quail.

Not met with by the Surveys, nor apparently by Ferguson or Bourdillon.

Nidification (iv, 286) records, however, that Stewart twice found it breeding in Travancore. As no specimens were apparently taken, further evidence is desirable before the species can be admitted to the Travancore list.]

Turnix tanki tanki Blyth. The Indian Button Quail.

Not met with by the Surveys.

Ferguson himself never came across this quail in Travancore, neither were there in his time (nor are there now) any skins in the Trivandrum Museum collection. He included the species in his Travancore list (*J.B.N.H.S.*, xvi, 5) in the belief that it had been recorded hence previously. He was evidently referring to the skin sent by Bourdillon from South Travancore to Hume. (Hume and Marshal, *Game Birds of India*, ii, 187).

In the Palni Hills, Terry (*S.F.*, x, 479) claims to have shot one of these quails, but the skin was not preserved and there has been no confirmation of its occurrence since. It has not been recorded from Ceylon.

Breeding: According to *Nidification* (iv, 287) Bourdillon found the Indian Button Quail breeding in South Travancore where he took eggs on 3 January.

ORDER: GRALLÆ.

SUB-ORDER: FULICARIÆ.

FAMILY: RALLIDÆ.

Hypotaenidia striata gularis (Horsfield). The Indian Blue-breasted Banded Rail.

Not met with by the Surveys.

Ferguson writes (*J.B.N.H.S.*, xvi, 5): 'These birds may be found scattered about in marshy thickets near the coast. From the contents of their stomach, beetles appear to be their chief food'.

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I have seen no Travancore specimens and there appear to be none in the British Museum except a pair in the Hume Collection from the 'West coast of Madras' which Mr. Whistler thinks may perhaps mean Travancore.

In the Palni Hills, Terry (*S.F.*, x, 480) shot a female on 4 April. This specimen is now in Dr. C. B. Ticehurst's collection (*J.B.N.H.S.*, xxxviii, 690).

It occurs in Ceylon.

Breeding: While presumably a resident species, nothing has been recorded about its breeding in Travancore or Cochin.

Porzana pusilla pusilla (Pallas). The Eastern Baillon's Crake.

Not met with by the Surveys.

Ferguson (*J.B.N.H.S.*, xvi, 5) records that a single specimen was brought to him alive in December. According to him it is apparently a rare bird in Travancore.

Mr. Whistler has examined a Travancore specimen in the British Museum Collection labelled: o 18-11-1878 Charki, Trivandrum (Bourdillon).

It has not been recorded from the Palni Hills, but it occurs in Ceylon evidently as a winter visitor.

Breeding: While the majority of birds in the peninsula are winter visitors only, some apparently remain behind to breed in the plains. There are no undoubted records of its breeding in Travancore or Cochin, but Ferguson mentions that the bird brought to him had evidently bred there as it was reported to have had a young one with it. In the absence of confirmation this record seems doubtful.

Rallus eurizonoides amauroptera (Jerdon). The Banded Crake.

Not met with by the Surveys.

Ferguson (*J.B.N.H.S.*, xvi, 5) procured a single specimen of this crake in 1875 in some paddy fields near the foot of the hills in South Travancore at about 400 ft. elevation. There is, according to Mr. Whistler, one Travancore specimen labelled 'Mynall' with no other data in the British Museum (Hume Collection), and a second, also without data, collected by Fry. It occurs in Ceylon.

Breeding: No information available for Travancore or Cochin.

Amaurornis fuscus subsp? The Ruddy Crake.

Specimen collected: 421 ♂ 7-3-33 Kūmili 3,000ft.

Elsewhere not noted.

Colours of bare parts: Iris reddish-orange; bill horny slate; legs and feet dusky coral; claws horny brown.

[The specimen, ♂, measures: Bill 22.5; Wing 101; Tail 50; Tarsus 35 mm.

Additional specimen seen: *Brit. Mus. Coll.*: o? no data (Travancore) (Bourdillon).

As explained in the Eastern Ghats Survey (*J.B.N.H.S.*, xxxviii, 692) I do not recognise the race *A. f. zeylonicus*. South Indian and Cinghalese birds are quite inseparable from the typical race of the Philippines. Southern birds measure: Wing 90.5-98.5 mm. North Indian birds (*A. f. bakeri*) have wings 100.5-109 mm. As the series from the South is inadequate and not properly sexed, these measurements may not be fully representative so I hesitate to draw the obvious deduction that the Survey specimen is a migrant of *A. f. bakeri*. Southern birds may possibly on occasion reach 101 mm. —H. W.]

The specimen was one of a pair in brushwood by a swamp on the margin of Periyār Lake. No others were seen.

According to Ferguson (*J.B.N.H.S.*, xvi, 5) the Ruddy Crake is fairly common in Travancore. I cannot say, however, whether this statement is based merely on the fact that there were 6 specimens (3 from Kottayam) in the Trivandrum Museum during his time, or on more substantial grounds.

It occurs in Ceylon, but as regards the Ceylonese race see Mr. Whistler's remarks, *supra*.

Breeding: *Nidification* (iv, 300) records that Stewart only once took a nest of this Crake in Travancore, but gives no other particulars.

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Amaurornis phoenicurus phoenicurus (Pennant). The White-breasted Waterhen.

Specimen collected: 420 ♀ 7-3-33 Kūmili (Periyār Lake) 3,000 ft.

Elsewhere noted at: Thattakād (200 ft.); Kōttayam Backwaters (Vembanād Lake, Munro Island, etc.). Arāmboli (250 ft.); Karūpadanna (ca. S.L.).

Colours of bare parts: Iris orange-brown; bill pale sage green, brownish on culmen; legs and feet dusky chrome yellow; claws horny-brown.

[The specimen measures: Bill 34.5, Wing 158, Tail 61.5, Tarsus 59 mm. No other Travancore specimens seen.—H. W.]

The White-breasted Water-hen is fairly common in Travancore and Cochin wherever there are paddy fields and swampy land whose marginal vegetation it habitually frequents. Ferguson (*J.B.N.H.S.*, xvi, 6) apparently believed it to be restricted to the low country.

It is usually seen singly or in pairs, skulking about amongst brushwood and *Pandanus* scrub on the edges of streams, tanks, paddy-fields and water channels. At the middle of April it was heard calling, chiefly at night and in the early mornings. The well-known call—indicative of the breeding season—is a monotonous, metallic *coot-coot-coot* (not unlike that of the Coppersmith) repeated in quick succession for quite 10 or 15 minutes at a stretch. A range of weird and raucous croaks and chuckles usually precedes the 'cooting'. The call is uttered from the centre or near the top of a bush into which the bird has clambered.

The same race occurs also in Ceylon.

Breeding: The ovary of the specimen (7 March) was undeveloped. No specific records are available, but Ferguson says that in Travancore it breeds in April.

Gallinula chloropus indicus Blyth. The Indian Moorhen.

Not met with by the Surveys.

Ferguson writes (*J.B.N.H.S.*, xvi, 6): 'The Moorhen is by no means common in Travancore; the Museum possesses only a single specimen'. No further information is available concerning the species in Travancore or Cochin.

Gallicrex cinerea (Gmelin). The Kora or Water-Cock.

Specimen collected: 1047 ♂ 30-12-35 Karūpadanna ca. S.L.

Elsewhere not noted.

Colours of bare parts: Iris hazel brown; upper mandible brownish olive-green, lower mandible pale olive yellow; forehead dusky olive; legs and feet olive green; claws horny brown.

[The specimen measures: Bill 43, Wing 215, Tail 83 mm.

Additional specimens seen: *Brit. Mus. Coll.*: 2 ♀♀ no data Anjango —H. W.]

The specimen—in non-breeding plumage—was solitary amongst bushes and brushwood bordering a kutcha pond at the edge of paddy cultivation. Ferguson (*J.B.N.H.S.*, xvi, 6) describes the Water-Cock as not uncommon (in Travancore) in and about rice cultivation in the low country.

It occurs in Ceylon.

Breeding: Nothing recorded for Travancore or Cochin.

Porphyrio poliocephalus poliocephalus (Latham). The Indian Purple Moorhen.

The Surveys did not come across this species, but it was accurately described to me and reported to be common about inundated paddy fields and around the backwaters at Kōttayam and Karūpadanna.

According to Ferguson (*J.B.N.H.S.*, xvi, 6) it is common on all the larger lakes (in Travancore) wherever there are reeds and rushes.

It is found in Ceylon.

Breeding: Ferguson says that in Travancore it breeds in July and August.

Sub-Order: Jacanæ.

Family: Jacanidæ.

Metopidius indicus (Latham). The Bronze-winged Jacana.

Specimen not obtained.

Noted at: Cape Comorin (ca. S.L.); Nemmāra (300 ft.).

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[Travancore specimens seen:
Brit. Mus. Coll.: ♂ 5-2-1879 Vellárney Lake (Bourdillon); one without data collected by Surgeon-General Fry.—H. W.]

This species appears to be rather uncommon in Travancore and Cochin. It was met with occasionally, either singly or in twos or threes, on lotus covered tanks.

Ferguson (*J.B.N.H.S.*, xvi, 7) however, says that it may be met with throughout Travancore in suitable localities where there are lakes or tanks well covered with weeds and water lilies.

Breeding: Bourdillon obtained eggs in Travancore in August (*Nidification*, iv, 321).

Hydrophasianus chirurgus (Scopoli). The Pheasant-tailed Jacana.

Not met with by the Surveys.

Ferguson (*J.B.N.H.S.*, xvi, 7) found flocks common in Travancore, especially about Nagercoil, keeping to the floating weeds well away from the banks.

Breeding: No information is available concerning its nidification in our area.

Sub-Order: Rostratulæ.

Family: Rostratulidæ.

Rostratula benghalensis benghalensis (Linn.). The Painted Snipe.

Not met with by the Surveys.

Ferguson (*J.B.N.H.S.*, xvi, 11) describes the Painted Snipe as fairly common throughout the low country wherever there are rushy marshes, and he also found it in paddy-fields. Stuart Baker (*Game Birds*, ii, 124) says that in Travancore it seems to be found up to 3,000 ft. and that he has had eggs sent him for identification taken at that elevation.

It occurs in Ceylon.

Breeding: In Travancore Ferguson had eggs brought to him in December and young birds in February. Nothing further seems to be recorded.

Sub-Order: Otides.

Family: Otididæ.

Sypheotides indica (Miller). The Lesser Florican or Likh.

Ferguson (*J.B.N.H.S.*, xvi, 6) writes that in 1876 a specimen was shot in some rushes in Trivandrum. I believe this is the only record for Travancore and its occurrence here must certainly be considered very exceptional.

ORDER: CHARADRIIFORMES.

Sub-Order: Oti-Limicolæ.

Family: Œdicnemidæ.

Burhinus oedicnemus indicus (Salvadori). The Indian Stone-Plover.

Not met with by the Surveys.

Ferguson (*J.B.N.H.S.*, xvi, 6) came across and shot these birds more than once when snipe-shooting at Veli—4 miles from Trivandrum. The soil in this locality was sandy and clothed with shrubs and cocoanut palms. The plovers were sometimes in small parties of 3 or 4, otherwise solitary.

Breeding: It is said (*ibid.*) to breed in Travancore in August.

Sub-Order: Laro-Limicolæ.

Family: Glareolidæ.

Sub-Family: Cursoriinæ.

Cursorius coromandelicus coromandelicus (Gmelin). The Indian Courser.

Not met with by the Surveys.

Ferguson (*J.B.N.H.S.*, xvi, 6) writes: 'My collector shot 2 of these 8 miles south of Quilon on some sandy plains in June 1902. Four more were sub-

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sequently obtained 12 miles south of Quilon. Among them was a young bird in quite immature plumage, so that I believe they must breed here. I have not found this bird in any other locality, and do not think it is likely to be seen further north.'

According to Stewart (apud *Nidification*, iv, 345) this Courser is common in the deforested areas of Travancore. We have no information concerning its occurrence or status in Cochin.

Breeding: Stewart (*ibid*) took many eggs in Travancore in bare ploughed fields, and gives the season here as May to July.

Sub-Family: Glareolinæ.

Glareola lactea Temminck. The Small Indian Pratincole or Sand-Plover.

Not met with by the Surveys.

Ferguson's collectors obtained specimens from Velyani, near Alwaye. They were met with in flocks of a dozen or more individuals frequenting open flats on either side of the Alwaye river up to Malayattur.

No other information from Travancore or Cochin is available.

Family: Stercorariidæ.

Catharacta skua lönnbergi Mathews. The Great Skua.

Specimen: 861 o? 20-9-33 Poojappura ca. 150 ft.—Trivandrum Environs.

The specimen was captured by fishermen in an exhausted condition on a large sheet of water—about 10 acres in extent—near the Karamanai river. It was solitary.

[Measurements: Bill 69, Wing 430, Tail 156, Tarsus 80 mm.

This specimen appears to provide the first record of this species for India. It was carefully identified for me at the British Museum by Mr. Hamilton when he was working at this puzzling group.

It will however be recalled that there are 5 records of Great Skuas for Ceylon, and there can be little doubt that if sufficient observers were present this species—speaking in the wide sense and without regard to the varying opinions as to the number of species and subspecies into which it may be divided—would be found to be a more or less regular straggler to the seas round Ceylon and South India. The known records appear to be as follows:

(1) A specimen brought alive to Legge in October 1875 with its wing clipped, said to have been caught a few weeks previously on the brackish canal which threads the lagoons between Negombo and Chilaw. Named as *Stercorarius antarcticus* (Legge, *Birds of Ceylon*, p. 1050).

(2) A specimen obtained by the lighthouse keeper at Foul Point, Trincomalee, caught in an exhausted state on the beach in a storm during the north-east monsoon between 1877 and 1885. This is in the Colombo Museum and was identified some years ago at the British Museum as *S. antarcticus*.

(3) A specimen shot, apparently between Chilaw and Negombo, in October 1885 and now in the Colombo Museum. Identified as *S. antarcticus antarcticus* (loc. cit.).

(4) A specimen obtained at Kalutara, 25 miles south of Colombo, on 22 September 1907 and now in the Colombo Museum. Identified as *S. a. antarcticus* (loc. cit.).

(5) A specimen seen at sea by Nicholl off the south-east of Ceylon in 5°23′ N×84°45′ E (Ticehurst, *J.B.N.H.S.*, xxxiv, 482).

It is not unlikely that an examination of the above specimens, in the light of recent research on this group, would result in some modification of the identifications.—H. W.]

Family: Laridæ.

Larus ichthyaëtus Pallas. The Great Black-backed Gull.

Specimens collected: 300 ♀ ad. 17-2-33, 307 ♂ ad., 308 ♂ imm. 18-2-33 Vembanād Backwaters, Kōttayam.

Elsewhere not noted.

Colours of bare parts: *Adult* Iris hazel brown; fine circumorbital ring (eyelids) coral red; basal 2/3 of bill bright yellow, followed by a bright reddish-orange patch and then by a subterminal band of blackish-brown. Tips paler,

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yellow; gape and mouth bright orange; legs and feet bright yellow; claws horny black. *Immature* Fine circumorbital ring (eyelids) blackish-brown; basal 2/3 of bill greenish-yellow or sulphur yellow, tip reddish orange; legs and feet greenish-yellow or sulphur yellow; rest as in adult.

[Measurements:

	Bill.	Wing.	Tail.	Tarsus.
1 ♂ ad.	76	481	197	71.5 mm.
1 ♀ ad.	70.5	440	174	69 mm.
1 ♂ imm.	77.5	482	189	75 mm.—H. W.]

The Great Black-backed Gull was noted in fair numbers and as the commonest species of gull on the Vembanād Backwaters during the period the Survey worked this area—in February. The birds were observed singly and in small loose flocks following fishing boats. On one occasion a gathering of 50 or more was noted in association with Caspian Terns on a mudbank in an inundated field by the margin of the backwaters. From the bill and gullet of No. 300 were recovered 9 sword-fishes (*Hemirhamphus xanthopterus* C.V.) each from 190-200 mm. long and weighing aggregately about 1 lb. From the gullet of No. 307 also 10 of these fishes were obtained, and it would appear that the food of this gull here consists largely of this species.

According to Ferguson (*J.B.N.H.S.*, xvi, 11) this gull reaches the Travancore coast on winter immigration not much earlier than January. During this month in 1903, his collectors shot 5 specimens at Kayankolam Bar.

Larus ridibundus Linn. The Black-headed Gull.

Specimen not obtained.

Noted (?) at: Vembanād Lake near Alleppy, Cochin Harbour.

Ferguson (*J.B.N.H.S.*, xvi, 11) writes that this gull was found by his collectors to be fairly common about Kāyankolam Bar in January 1903, but apparently no specimens were procured by them.

Larus brunnicephalus Jerdon. The Brown-headed Gull.

Specimen not obtained.

Noted (? this or *ridibundus* or both) near Alleppey and in Cochin Harbour in January and February. At the latter place they were observed in association with *Gelochelidon nilotica* feeding on floating garbage and human ordure from the town.

Ferguson (*J.B.N.H.S.*, xvi, 12) secured a specimen on the sandy banks of a shallow lake close to the sea near Cape Comorin in December (1901). He found numbers of these gulls surrounding fishermen drawing their nets.

Larus fuscus taimyrensis Buturlin. The Eastern Herring Gull.

Not met with by the Surveys.

Ferguson's collectors obtained a single specimen at Kāyankolam in January 1903 (*J.B.N.H.S.*, xvi, 12) which was recorded as *Larus affinis* and therefore presumably belonged to the above race.

Family: Sternidæ.

Chlidonias leucoparcia indica (Stephens). The Indian Whiskered Tern.

Specimen collected: 306 ♂ ad. 18-2-33 Vembanād Backwaters, Kōttayam.

Elsewhere noted at: Karūpadanna (unconfirmed).

Colours of bare parts: Iris dark greyish-brown; bill dark reddish-brown; legs and feet dark coral brown; soles brighter coral; claws black.

[Measurements: Bill 35.5; Wing 222; Central tail 67; Outer tail 79; Tarsus 21.5 mm. As shown in the E. Ghats Survey (*J.B.N.H.S.*, xxxix, 247) Ceylon birds treated as *C. l. leggei* in the *Fauna*, are not separable from Indian specimens. The bird is not of course known to breed in Ceylon which is evidently visited by our North Indian breeding birds.—H. W.]

I only came across this tern—in fair numbers—in the backwaters where they were commonly seen following fishing boats or perched on stakes and dykes, close to the sea. Ferguson (*J.B.N.H.S.*, xvi, 12) describes it as

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abundant in North Travancore in the winter months, frequenting the coast, the backwaters and paddy fields.

It is a common (winter) visitor to Ceylon.

Hydroprogne caspia caspia (Pall.) The Caspian Tern.

Specimens collected: 309 ♀ ad., 310 ♀ ad. 18-2-33 Vembanād Backwaters, Kōttayam.

Elsewhere not noted.

Colours of bare parts: Iris dark brown; bill bright orange-scarlet, duskier near tips; mouth orange-scarlet, gullet paler; legs, feet and claws black.

[Measurements:

	Bill.	Wing.	Tail.	Tarsus.
2 ♀♀ ad.	76-77	390-398	136-138	45 mm.—H. W.]

Several of these large terns were observed in association with Great Black-headed Gulls on a mudflat in the midst of inundated backwater paddy fields, not far from Alleppey. Ferguson (*J.B.N.H.S.*, xvi, 12) found it in fair numbers at Kāyankolam Bar in January 1903.

It is a fairly common visitor to the north coast of Ceylon during the North-East Monsoon, and a few remain behind to breed.

Gelochelidon nilotica nilotica (Gmelin). The Gull-billed Tern.

Specimens collected: 1037 ♂ ad., 1038 ♀ ad. 29-12-33 Karūpadanna (Backwaters).

Elsewhere noted: Cochin Harbour.

Colours of bare parts: ♂ (1037); Iris dark brown; bill, legs, feet and claws brownish-black; mouth orange-pink, ♀ (1038) legs and feet orange-brown, rest as above.

[Measurements:

	Bill.	Wing.	Tail.	Tarsus.
1 ♂	49·5	322	125	35·5 mm.
1 ♀	43·5	316	92	33 mm.—H. W.]

Small flocks of the Gull-billed Tern were observed about the inundated paddy cultivation and cocoanut fibre pans along the backwaters. In Cochin Harbour, several were seen flying about in company with gulls, feeding on the floating human ordure washed out from the town. The stomachs of the specimens contained remains of shrimps and other crustaceans.

Ferguson (*J.B.N.H.S.*, xvi, 12) describes this tern as fairly common in winter about the backwaters of North Travancore, and also frequenting the coast at Manakolam Bar.

It is common in Ceylon during the North-east Monsoon, but a few may be seen throughout the year.

Thalasseus bergii velox (Cretzsch.) The Red Sea Large Crested Tern.

Specimens collected: 1007 ♂ add., 1008 ♀ imm. 25-12-33; 1036 ♂ imm. 29-12-33 Karūpadanna Backwaters.

Elsewhere not noted.

Colours of bare parts: 1007 & 1008; Iris dark brown; bill greenish lemon yellow; legs, feet and claws brownish-black. 1036: Iris shot damaged; bill creamy greenish-yellow; legs and feet greenish yellow, irregularly blotched with black; claws horny brown.

[As shown in the Eastern Ghats Survey (*J.B.N.H.S.*, xxxix, 248) I am not able to recognise the supposed Ceylon race *T. b. edwardsi*.

Measurements:

	Bill.	Wing.	Central Tail.	Outer Tail.	Tarsus.
1 ♂ ad.	72.5	342 (worn)	89	180	31 mm.
1 ♂ imm.	67	339	85	136	28 mm.
1 ♀ imm.	67.5	348 (worn)	91	167	31 mm.—H. W.]

These terns— in fair numbers—were observed singly, perched on fishing stakes etc. in the backwaters, close to the sea.

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Ferguson (*J.B.N.H.S.*, xvi, 12) found numbers at Kāyankolam Bar (ca. 9° 10′ N×76° 30′ E) and further north in December and January (1903-4).
It is common in Ceylon and breeds in the Gulf of Manaar.

Thalasseus bengalensis bengalensis (Lesson). The Indian Lesser Crested Tern.

Specimens collected: 301 ♂ ad. 17-2-33 Vembanād Backwaters, Kōttayam; 1049 ♂ ad. 31-12-33 Karūpadanna Backwaters.
Elsewhere not noted.
Colours of bare parts: Iris dark brown; bill chrome yellow; palate same; gullet pale flesh colour; legs and feet brownish-black; soles yellow; claws blackish-brown.

[Measurements:

	Bill.	Wing.	Central Tail.	Outer Tail.	Tarsus.
2 ♂♂ ad.	63	280-6 (worn)	65-71	130-40	25-26 mm.—H. W.]

Several of these terns were observed following fishing boats or perched on fishing stakes in the backwaters, close to the sea, frequently in association with *T. bergii* and *Gelochelidon nilotica*.
According to Ferguson (*J.B.N.H.S.*, xvi, 12) it is the commonest and most abundant of the terns in Travancore, frequenting the backwaters and coast from Quilon northwards.
It is common all round the coast of Ceylon in the North-east Monsoon.

Sterna hirundo Subsp.? The Common Tern.

Specimens not obtained.
Several noted flying up and down the Ponnāni River at Shoranūr on the northern boundary of Cochin—29-11-33. Nowhere else (This or *S. aurantiaca* Gray?).
According to Ferguson (*J.B.N.H.S.*, xvi, 13) who seems to have taken a few immature specimens, this tern is an occasional winter visitor to the coast of South Travancore. He had not met with it in North Travancore at all.

Sterna albifrons saundersi Hume. The Black-shafted Ternlet.

Not met with by the Surveys.
Ferguson records a single specimen shot on the coast of North Travancore in January 1903.

Sub-Order: Limicolæ.

Family: Charadriidæ.

Sub-Family: Pre-Charadriinæ.

Arenaria interpres interpres (Linn.). The Turnstone.

Specimens collected: 525 ♀, 526 ♂, 527 ♀ 7-4-33 Cape Comorin, S.L.
Elsewhere not noted.
Colours of bare parts: Iris brown; bill dark horny brown; legs and feet bright reddish orange; claws horny black.

[Measurements:

	Bill.	Wing.	Tail.	Tarsus.
1 ♂	26	152	60	25.5 mm.
2 ♀♀	25-26	154-8	61.5-64	24.5-26 mm.—H. W.]

A flock of about 15 birds was seen amongst rocks on the sea-shore, feeding on barnacles (?) and minute crustaceans. The specimens were undergoing heavy body moult into breeding plumage. Their wing- and tail-quills were fresh. They were very fat and evidently preparing to emigrate shortly.
The Turnstone has apparently not been recorded from Travancore previously, although it is a fairly common winter visitor to Ceylon.

Leucopolius alexandrinus alexandrinus (Linn.). The Kentish Plover.

Specimens collected: 703 ♂ 21-7-33 Beach, Trivandrum; 1000 ♀ imm., 1010 ♀ imm. (?), 1011 ♀ ad. 25-12-33 Karūpadanna, ca. S.L.
Elsewhere not noted.

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Colours of bare parts: Iris dark brown; bill blackish-brown, paler at chin; legs brownish-grey; feet greyish-brown; claws horny black. (No. 703 'Iris dark brown; bill slaty; legs and feet light straw; claws slaty' (Pillai).

[Measurements:

	Bill.	Wing.	Tail.	Tarsus
3 ♀♀	20-21	106-114.5	42.5-49	27.5-28 mm.

The 3 females, Nos. 1009-1011, undoubtedly belong to the typical race from which they can be distinguished neither in colour nor in size. They were doubtless winter visitors to Travancore. No. 703 on the other hand is a smaller bird (Bill 18; Wing 150; Tail 46.5; Tarsus 27.5) and would appear to be a juvenile of a local breeding form. The Kentish Plover has not yet been otherwise recorded as breeding in Travancore, but if it does breed there I have little doubt that the breeding form will prove to be *L. a. leggei* as in Ceylon.—H. W.]

Small flocks of the Kentish Plover were observed on a sand-bar separating the backwaters from the sea. Ferguson (*J.B.N.H.S.*, xvi, 8) found this species to be fairly numerous at Neendakaray on the coast near Quilon, in January.

The smaller race, *L. a. leggei*, breeds in Ceylon.

Haematopus ostralegus ostralegus Linn. The Oyster-Catcher.

Not met with by the Surveys. According to Ferguson (*J.B.N.H.S.*, xvi, 9) this is a more or less rare winter visitor to the Travancore coast, found generally in small flocks of half a dozen or so, feeding on crustaceans mostly.

Sub-Family: Charadriinæ.

Charadrius dubius [**jerdoni** (Legge).] Jerdon's Little Ringed Plover.

Specimens collected: 512 ♀ 5-4-33 Vellayāni Lake, Trivandrum Environs; 549 ♀ 9-4-33 Cape Comorin ca. S.L.; 699 ♂ imm. 21-7-33, 766 ♂ imm. 1-8-33 Beach, Trivandrum; 1006 ♀ 25-12-33 Karūpadanna ca. S.L.

Elsewhere noted at: Kūmili, by margin of Periyār Lake (ca. 3,000 ft.).

Colours of bare parts: Iris brown; ring round eye (eyelids) yellow; bill horny black, yellow at chin; legs and feet dusky greenish-yellow in No. 1006 (pale yellowish-flesh with pinkish tinge); claws horny black.

[Measurements:

	Bill.	Wing.	Tail.	Tarsus.
1 ♂ ad.	18.5	117	58	25 mm.
1 ♂ juv.	15	108	moult	25 mm.
2 ♀♀ ad.	15-17.5	114	55-57	23-24 mm.
1 ♀ juv.	18	119	59	25 mm.

I find considerable difficulty in identifying these birds for the reason that I have not been able—for lack of material—to decide whether *C. d. jerdoni* is a good race, and if so what are its limits of variation in size and colour. There is only one unsexed Ceylon bird in the British Museum (Bill 18; wing 117 mm.).

There is much variation throughout India in the size of Little Ringed Plovers and I am far from satisfied that *jerdoni* is separable from *curonicus*. Should it be so separable, the probability is that the Travancore birds should be attributed to the former race as they were evidently on their breeding ground, but it will be noted that their measurements, agreeing with the single Ceylon specimen, fall within the limits commonly attributed to *curonicus*. —H. W.]

These little plovers were met with in pairs or small parties about the margins of tanks and streams, and on marshy grassland by paddy fields etc. Ferguson (*J.B.N.H.S.*, xvi, 8) did not believe it to be a resident species in Travancore, but I think it is more than likely that some at any rate breed here. Mr. Pillai found the birds fairly common about the Trivandrum beach during July and August. Both the specimens obtained by him then were juvenile with imperfectly ossified skulls and undergoing complete post-juvenal moult.

No specific instance of its breeding in Travancore or Cochin has hitherto been recorded, however.

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Cirrepedesmus mongolus atrifrons (Wagler). The Pamirs Lesser Sand-Plover.

Specimens collected: 523 ♀, 524 ♀ 7-4-33 Cape Comorin ca. S.L.

Elsewhere not noted.

Colours of bare parts: Iris brown; bill black; mouth pinkish-grey; legs greenish-grey; feet and claws blackish-brown.

[Measurements:

	Bill.	Wing.	Tail.	Tarsus.
2 ♀♀	21-22.5	126.5-127	46-46.5	33 mm.

Additional specimen seen. *Van der Sleen Coll.*: ♂ 7-9-1926 Travancore, west of Parasala.—H. W.]

A flock of about 25 birds was met with on the sea-shore. They flew in close formation, turning and twisting on the wing in orderly fashion, all together and as one bird. Ferguson (*J.B.N.H.S.*, xvi, 8) describes this Sand-Plover as a winter visitor to the Travancore coast, but sometimes found inland, one specimen even being obtained on the High Range at 6,000 ft. elevation!

Cirrepedesmus leschenaultii (Lesson). The Large Sand-Plover.

Not met with by the Surveys.

Ferguson (*J.B.N.H.S.*, xvi, 8) says: 'A rare winter visitor to the coast. A single specimen was shot at Neendakaray near Quilon.'

Pluvialis dominicus fulvus (Gmelin). The Eastern Golden Plover.

Specimen not obtained.

Noted (unconfirmed) at: Kōttayam. A flock of 4 birds flying across the Vembanād Lake, 15-2-1933.

Ferguson (*J.B.N.H.S.*, xvi, 8) says: 'Flocks of these plovers may be met with commonly in North and Central Travancore, about Cherayankie, Parur and Vycome in winter, frequenting swampy flats and in paddy fields.'

Sub-Family: Vanellinæ.

Chettusia gregaria (Pallas). The Sociable Lapwing.

Not met with by the Surveys.

In January 1900, Ferguson (*J.B.N.H.S.*, xvi, 8) shot 2 specimens from a flock of 5, feeding in some paddy fields near Trivandrum. He thought that the failure of the monsoon in the north the season before and the consequent drought may have driven the birds so far south of their accustomed winter range in India.

Lobivanellus indicus (Boddaert). The Indian Red-wattled Lapwing.

Specimen collected: (not sexed) 9-12-33 Nemmāra 300 ft. (Preserved in alcohol for morphological study).

Elsewhere noted: Thattakād (200 ft.); Wadakkāncheri (400 ft.); Karūpadanna ca. S.L.

Colours of bare parts: Iris brown; eyelids and wattles cherry red; bill terminal 1/3 black, basal 2/3 cherry red; legs and feet greenish-yellow; claws horny black.

The Red-wattled Lapwing was commonly, but not abundantly, met with in the low country of Travancore and Cochin—in pairs or small (family?) parties, by streams, tanks and swampy fields etc.

In the Palni Hills, Terry (*S.F.*, x, 480) heard this lapwing calling overhead at night at Pittur, but never saw it.

Breeding: The season in Travancore according to Ferguson (*J.B.N.H.S.*, xvi, 7) is March.

Lobipluvia malabarica (Boddaert). The Yellow-wattled Lapwing.

Specimens collected: 587 ♀, 588 ♂ 13-4-33 Cape Comorin ca. S.L.; 769 ♀ 2-8-33 Golf Links, Trivandrum.

Elsewhere noted at: Wadakkāncheri (400 ft.); Karūpadanna ca. S.L.

Colours of bare parts: Iris dark khaki; bill terminal 2/3 brownish-black, basal 1/3 greenish yellow; circumorbital ring (eyelids), gape and wattles greenish- or sulphur-yellow; legs and feet greenish-yellow; claws brownish-black,

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[Additional specimens seen: *Brit. Mus. Coll.*: ♂ 20-6-77 Trivandrum (Hume Coll.); 0-1-73 Kolachul (Bourdillon).

Measurements:

	Bill.	Wing.	Tail.	Tarsus.
2 ♂♂ ad.	26-28	186-188	72-73·5	59·5-63 mm.
2 ♀♀ ad.	27·5-29	185-196	75·5-78	58-60 mm.
1 ♀ juv.	...	178	73	... mm.—H. W.]

This lapwing is also fairly common in the low country of both Travancore and Cochin. *Nidification* (iv, 401) describes it as 'extraordinarily common' (in Travancore), which is perhaps an overstatement of the case. The birds were observed in pairs or small parties of 4 or 5, frequenting open fallow land and ploughed and stubble fields—altogether drier facies than the foregoing.

It is a resident species in Ceylon.

Breeding: Specimen No. 587 (13 April) had a mature ovary with some of the follicles measuring 4 mm. in diameter. The testes of the male measured about 6×4 mm. and were evidently enlarging. Both these birds were in fresh plumage and doubtless preparing to breed. In the August specimen the ovary was in a quiescent state.

Bourdillon *Nidification*, iv, 401) found this lapwing breeding in Travancore from 3 March to 13 August: Stewart from 4 April to 6 August. The full clutch of eggs is said to be 4, but sometimes only 3 are laid.

A remarkable case of colour adaptation of eggs to environment, revealed by J. Stewart in Travancore, has been described by Mr. Stuart Baker in the Society's *Journal* (xxxv, 250). Stewart, it seems, took numerous clutches of the eggs of this bird on red laterite as well as on adjoining black soil. Practically every clutch found on laterite soil was erythristic and every clutch on the black soil normally coloured.

Family: Scolopacidæ.

Sub-Family: Tringinæ.

Numenius arquata (Linn.) subsp.? The Curlew.

Not met with by the Surveys.

According to Ferguson (*J.B.N.H.S.*, xvi, 9) the Curlew is found on the Travancore coast in winter, but not in any great numbers.

Numenius phæopus (Linn.) subsp.? The Whimbrel.

Not met with by the Surveys.

In Travancore, Ferguson writes (*J.B.N.H.S.*, xvi, 9) that it may be found in suitable places along the coast in fair numbers from October to April, usually as a solitary bird.

Tringa ochropus Linn. The Green Sandpiper.

Specimens collected: 174 ♂ 28-1-33 Sānthanpāra 3,000 ft. (Cardamom Hills).

Elsewhere noted at: Mūnnār (5,000 ft.); Kūmili (3,000 ft.); Vellayani Lake, Trivandrum Environs; Nemmāra (300 ft.).

Colours of bare parts: Iris brown; bill greenish-brown, duskier near tip, greener near base; legs and feet greyish sage green; claws horny brown.

[Measurements:

	Bill.	Wing.	Tail.	Tarsus.
1 ♂	39·5	143	59	34 mm.—H. W.]

The Green Sandpiper was met with by the Surveys singly and sparingly, by streams, tanks and puddles, both in the low country and the hills—up to about 5,000 ft. Ferguson (*J.B.N.H.S.*, xvi, 9) shot an example at a swamp on the High Range at an elevation of 6,000 ft. in January. Like all other sandpipers, it is of course only a winter visitor to our area, as it is to Ceylon.

A specimen ringed by the Russians in the environs of the city of Kazan (55°48′N×49°26′E) in June 1929 was recovered near Kōttayam in September 1933. The distance between these two points is 3,500 miles.

In the Palni Hills, Terry (*S.F.*, x, 480) shot one in the Pittur Valley as late as 4 May.

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Tringa glareola Linn. The Wood Sandpiper.

Specimen collected: 1046 ♂ 30-12-33 Karūpadanna ca. S.L.

Elsewhere noted at: Cape Comorin, Nemmāra (300 ft.).

Colours of bare parts: Iris dark brown; bill basal half olive-brown; terminal half blackish-brown; legs and feet olive green; claws horny-brown.

[Measurements:

	Bill.	Wing.	Tail.	Tarsus.
1 ♂	34	127	49	36.5 mm.—H. W.]

Wood-Sandpipers were met with in the low country of Travancore and Cochin in small loose flocks—on one occasion of over 20 birds—on swampy or inundated ploughed fields by irrigation tanks and along the backwaters.

Ferguson writes (*J.B.N.H.S.*, xvi, 9) that this is by far the commonest of the sandpipers (in Travancore) and may be found in abundance in the wet paddy fields from August to May, either solitary or in flocks.

Tringa stagnatilis (Bechstein). The Marsh Sandpiper.

Not met with by the Surveys.

Ferguson (*J.B.N.H.S.*, xvi, 9) states that his collectors found flocks on the seashore at Manakolam Bar and at North Parur in Travancore, presumably in winter.

Tringa hypoleucos Linn. The Common Sandpiper.

Specimen collected: 489 ♀ 24-3-33 Tenmalai ca. 500 ft.

Elsewhere noted at: Mūnnār (on Mūnnār stream 5,000 ft.); Thattakād (on Periyār river, 200 ft.); Kōttayam (backwaters); Camp Derāmalai (at Uppukulam tank among grassy hiltops, 4,000 ft.); Periyār Lake margin (ca. 3,000 ft.); Vellayani Lake, Trivandrum Environs; Cape Comorin; Arāmboli (250 ft.); Kūriārkūtti (1,600 ft. on Parambikolam river); Wadakkāncheri (400 ft.), Nemmāra (300 ft.); Ernākulam (backwaters).

Colours of bare parts: Iris brown; bill greenish-brown, duskier near tip, greener near base; legs and feet greyish sage-green; claws horny brown.

[Measurements:

	Bill.	Wing.	Tail.	Tarsus.
1 ♀	29	112	56	24 mm.—H. W.]

In winter, the Common Sandpiper is widely distributed but not abundant in Travancore and Cochin. It was met with solitary as a rule on streams, tanks, puddles, the rocky sea-shore and by the backwaters. According to Ferguson it is common in Travancore from September to May.

It is a winter visitor also to Ceylon.

Tringa totanus (Linn.). The Redshank.

Specimen not obtained.

Noted only at Karūpadanna along the backwaters where it was uncommon. Occasional solitary birds were observed feeding on mudbanks etc. and their familiar call uttered in flight, *Tew-tew-tew* was frequently heard at night. A single specimen was shot by Ferguson's collectors at Neendakaray (near Quilon) in January 1903 (*J.B.N.H.S.*, xvi, 10).

Glottis nebularia (Gunnerus). The Greenshank.

Specimen not obtained.

Noted only at Karūpadanna, usually solitary, on mudbanks in the backwaters. Uncommon. Ferguson (*J.B.N.H.S.*, xvi, 10) says that he did not meet with this species in South Travancore, but that his collectors saw flocks on the sides of the rivers and in marshes in North Travancore. They obtained specimens at Yettamane, Shertally and Vycome.

Sub-Family Eroliinæ.

Erolia minuta [**minuta** (Leisler)]. The Little Stint.

Not met with by the Surveys.

Ferguson (*J.B.N.H.S.*, xvi, 10) describes it as 'A fairly common visitor to the coast of North Travancore in winter, but not found inland. It often

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associates with *Tringa subarquata* [=*Erolia testacea*]. It forms larger flocks, as a rule, than other stints.'

Erolia testacea (Pallas). The Curlew-Stint or Pigmy Sandpiper.

Not met with by the Surveys.

According to Ferguson (*J.B.N.H.S.*, xvi, 10) 'This fine stint is found from October to April on the coast of North Travancore, especially about Manakolam Bar. When it associates with *T. minuta*, only a few individuals are found, but it forms flocks of from 8 to 12 when alone.'

Limicola falcinella falcinella (Pontopp.). The Broad-billed Sandpiper.

Not met with by the Surveys.

A single specimen was obtained by Ferguson's collectors at Manakolam Bar in January 1903 (*J.B.N.H.S.*, xvi, 10).

Sub-Family : Scolopacinæ.

Scolopax rusticola rusticola Linn. The Woodcock.

Not met with by the Surveys.

Ferguson writes (*J.B.N.H.S.*, xvi, 10) 'Occasional specimens of this bird may be met with in grassland bordered by forest in South Travancore at elevations of about 4,000 ft. in winter. On the High Range in similar localities before the forest was cut down for tea and coffee cultivation it used to be fairly common at this period.'

In the Nelliampathy Hills, Kinloch (*J.B.N.H.S.*, xxvii, 943) describes the Woodcock as very rare and presumably a passage migrant at the end of September and the beginning of October, and again early in March.

In the Palnis, Fairbank (*S.F.*, v, 408) flushed one in the Kodaikanal in 1867, and records another shot in the same locality subsequently. He says that they are rare on those hills.

Capella nemoricola (Hodgson). The Wood Snipe.

Not met with by the Surveys.

In Ferguson's time, the Trivandrum Museum contained a single specimen shot on the High Range of Travancore (*J.B.N.H.S.*, xvi, 10).

Capella gallinago gallinago (Linn.). The Common or Fantail Snipe.

Specimen not collected.

Noted (unconfirmed) at: Māraiyūr (3,000 ft.); Kōttayam (Munro Island, Vembanād Backwaters); Trivandrum Environs (Vellayani Lake); Karūpadanna.

The birds were met with in swampy stubble paddy fields along the backwaters and inland. My impression is that it is less common and abundant in Travancore and Cochin than the Pintail Snipe. According to Ferguson (*J.B.N.H.S.*, xvi, 11) this species forms about ¼ or 1/3 of the bag in a day's snipe-shooting. In North Travancore he was told the proportion is higher. He says that it arrives in Travancore later than the Pintail and leaves earlier.

In the Palni Hills, both Fairbank and Terry found this snipe in small numbers in the cold season at the western end of the Kodaikanal Lake and in other swampy places. Terry shot 4 birds on 3 April, and the last seen by him was on 4 May.

Capella stenura (Bonaparte). The Pintail Snipe.

Specimens collected: 114 ♀ 19-1-33 Mūnnār 5,000 ft. (Kanan Devan Hills); 294 ♀ 17-2-33 Munro Island (Vembanād Backwaters); 414 ♀ 7-3-33 Kūmili 3,000 ft. (Periyār Lake margin).

Elsewhere noted at: Camp Derāmalai ('Single at Uppukulam tank among grassy hilltops 4,000 ft.'); Cape Comorin; Karūpadanna.

Colours of bare parts: Iris brown; bill horny brown, darker at tip, pale greenish at chin and base of lower mandible; legs and feet greyish green; claws dark brown.

[Measurements:

	Bill.	Wing.	Tail.	Tarsus.
3 ♀♀	66.5-73.5	132-137	48-51	33-35.5 mm.—H. W.]

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The Pintail Snipe is a common and fairly abundant winter visitor to Travancore and Cochin. It was met with principally in and about marshy stubble fields along the backwaters, but in smaller numbers wherever there was any grassy marsh—in the low country as well as on the hills. The birds were plentiful on Munro Island (Vembanād Lake) among the cut paddy fields and by the grass-fringed cocoanut irrigation trenches, and afforded good sport. Ferguson says (*J.B.N.H.S.*, xvi, 11) that in Travancore a few stragglers arrive early in September and that a few belated individuals may be found at the end of April. The last date on which one was shot by the Travancore Survey was 10 April (Cape Comorin). The bird was then undergoing heavy body moult. The specimen of 17 February was also in heavy body moult, while that of 7 March was moulting its rectrices. The Pintail Snipe is an abundant winter visitor to Ceylon.

Lymnocryptes minima Brunnich. The Jack Snipe.

Not met with by the Surveys.

Ferguson writes (*J.B.N.H.S.*, xvi, 11): 'A few specimens of this little snipe used generally to be found solitary from year to year on certain damp rushy ground in Trivandrum; since this has been taken into cultivation, I have not met with any more.'

According to Fairbank (*S.F.*, v, 410) the Jack Snipe visits the Palni Hills in the cold weather in small numbers, being found at the west of the Kodaikanal Lake and in other swampy places.

ORDER: STEGANOPODES.

FAMILY: PELECANIDÆ.

Pelecanus philippensis Gmelin. The Spotted-billed Pelican.

Not met with by the Surveys.

Ferguson did not secure a specimen, but says (*J.B.N.H.S.*, xvi, 13) that this Pelican occurs in South Travancore and that he once saw 3 flying over the parade ground in Trivandrum.

FAMILY: PHALACROCORACIDÆ.

SUB-FAMILY: PHALACROCORACINÆ.

Phalacrocorax niger Vieillot. The Little Cormorant.

Specimen not collected.

Noted only on the Ponnāni river at Shoranūr (North Cochin)—a flock of over 30 birds sunning themselves, wings outspread, on a sandbank in the afternoon.

Ferguson (*J.B.N.H.S.*, xvi, 13) observed this cormorant on the tanks and lakes in and about Nagercoil in South Travancore.

It is doubtless a resident species in our area, but nothing appears to be recorded about its breeding here.

SUB-FAMILY: ANHINGINÆ.

Anhinga melanogaster Pennant. The Indian Darter or Snake-Bird.

Specimen not obtained.

Noted at: Thattakād (200 ft.—Periyār river); Kūmili (3,000 ft.—Periyār Lake); Kūriārkūtti (1,600 ft.—Parambikolam river).

The Darter is a fairly common but not abundant resident species in Travancore and Cochin. It was usually met with solitary or in twos and threes on rivers and tanks. On the Periyār Lake, the exposed tops of the submerged tree-trunks seemed to provide favourite perches for these birds for sunning themselves, and as look-out posts.

Breeding: Ferguson points out (*J.B.N.H.S.*, xvi, 13) that in Travancore it breeds in September as in Northern India, and not in February as it does in Madras and Ceylon. T. F. Bourdillon found a colony nesting on small trees on an island in the Kodasheri river above the Athirapuzha fall in September. The nests then contained fresh and hard-set eggs in all stages, as well as half-fledged young.

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FAMILY: FREGATIDÆ.

Fregata andrewsi Mathews. The Christmas Island Frigate-Bird.

Not met with by the Surveys.

Ferguson writes (*J.B.N.H.S.*, xvi, 13): 'A young bird of this species taken at Perumathoray, about 10 miles from Trivandrum, was brought to me alive.' Another specimen obtained at Quilon was sent to the Bombay Natural History Society in July 1928 by Mr. L. A. Lampard. It was caught in a fishing net in a rough sea at the onset of the monsoon (*J.B.N.H.S.*, xxxiii. 445). It would appear, therefore, that it is not unusual for these birds to be blown ashore periodically by the violent gales of the south-west monsoon.

ORDER: TUBINARES.

Puffinus persicus Hume. The Persian Shearwater.

Not met with by the Surveys.

Ferguson (*J.B.N.H.S.*, xvi, 14) states that a specimen taken at Valey (Veli) four miles from Trivandrum, was brought to him alive. Unfortunately no date is given.

ORDER: HERODIONES.

FAMILY: IBIDIDÆ.

Threskiornis melanocephalus (Latham). The White Ibis.

Not met with by the Surveys.

Ferguson (*J.B.N.H.S.*, xvi, 14) came across the White Ibis only during the cold weather at Sāstancōttah, and was doubtful about the bird being a resident in Travancore. He says the birds were feeding by day in the paddy fields and roosting in trees on the bank of the lake, and that they were wary and difficult to approach.

SUB-ORDER: CICONIÆ.

Dissoura episcopa episcopa (Boddaert). The White-necked Stork.

Specimen not obtained.

Noted at: Thattakād (200 ft.); Wadakkāncheri (400 ft.); Shoranūr (Ponnāni river).

These storks were observed on a few occasions in pairs or small parties of 4 or 5, in the neighbourhood of water either soaring in circles at great height or feeding on sandbanks etc. in association with egrets.

Ferguson (*J.B.N.H.S.*, xvi, 14) mentions a specimen in the Trivandrum Museum from Palode, and another brought alive to him from Nagercoil.

Leptoptilos javanicus (Horsfield). The Smaller Adjutant.

Specimen not obtained.

Noted at: Kūriārkūtti (1,600 ft.—Annemalai Hills, Cochin). A pair on an open marshy patch amidst mixed deciduous and bamboo jungle (15 and 18 November 1933); very shy.

According to Ferguson (*J.B.N.H.S.*, xvi, 14) this Adjutant is by no means common in Travancore, but may be found about the tanks in S. Travancore whence live specimens were brought to the Trivandrum Zoo from time to time.

Anastomus oscitans (Bodd.). The Open-bill.

Ferguson (*J.B.N.H.S.*, xvi, 15) describes the Open-billed Stork as very common in Travancore, where large flocks may be met with on the marshy borders of all the larger tanks and fresh-water lakes, sharing the trees for roosting with flocks of Darters.

Curiously enough the Surveys altogether failed to come across the species in Travancore or Cochin.

Breeding: Ferguson did not take eggs, but he believed that the breeding season in Travancore was in June. No confirmation is available.

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Sub-Order: Ardeæ.

Family: Ardeidæ.

Ardea purpurea manillensis Meyen. The Eastern Purple Heron.

Specimen not obtained.

Noted in small numbers, usually solitary, on the reedy margins of the backwaters at Kōttayam (Vembanād) and Karūpadanna.

Long ago F. W. Bourdillon found the Purple Heron abundant at the Vellayani Lake, 7 miles from Trivandrum, but even in 1904 Ferguson pointed out (*J.B.N.H.S.*, xvi, 15) that since the reeds had been removed none were to be seen there. He saw and shot specimens at Sāstancōttah.

Breeding: In Travancore, Stewart and Bourdillon obtained fresh eggs between July and September (*Nidification*, iv, 456).

Ardea cinerea cinerea Linn. The Common Grey Heron.

Specimen not obtained.

Noted at Karūpadanna, Cochin State. A solitary bird (29 December) on a reed-covered islet in the backwaters.

In Travancore, according to Ferguson (*J.B.N.H.S.*, xvi, 15) the Grey Heron frequents the backwaters along the entire coast, but is not found in the interior. He mentions a specimen that had been living in the Trivandrum Zoo for over 17 years.

Egretta alba [**modesta** (Gray).] The Eastern Large Egret.

Specimen not obtained.

Noted only at Karūpadanna (Cochin). A solitary bird on a reed-covered mudbank in the backwaters.

Ferguson (*J.B.N.H.S.*, xvi, 15) writes that the Large Egret is by no means common in Travancore, and usually met with singly in inundated paddy fields. At Sāstancōttah he found them roosting gregariously on trees round the lake in association with Ibises and Snake-birds. He remarks that here the Egrets arrived long after the other birds had settled down for the night.

Breeding: No records relating specifically to our area are available.

Egretta intermedia intermedia (Wagler). The Indian Smaller Egret.

Specimen collected: 1025 ♂ 27-12-33 Karūpadanna (backwaters).

Elsewhere noted at: Kōttayam (Munro Island, Vembanād Lake); Shoranūr (on Ponnāni river); Nemmāra (300 ft.—by tanks and inundated paddy fields).

Colours of bare parts: Iris yellowish cream; bill lemon yellow, dusky at tip; lores and infra-orbital skin greenish-yellow; legs, feet and claws black.

[Measurements:

	Bill.	Wing.	Tail.	Tarsus.
1 ♂	94	302	121.5	111.5 mm.—H. W.]

The Smaller Egret is a fairly common but not abundant species about the backwaters of Cochin and Travancore. It also frequents tanks and inundated paddy cultivation inland. Solitary birds, pairs or small parties of 3 or 4 were usually seen. At Nemmāra I found them to be much persecuted by local 'sportsmen' armed with muzzle-loaders, and this is probably the case all over since the birds everywhere were inordinately wary.

This egret is a resident in Ceylon.

Breeding: Nothing appears to be published concerning its nidification in Travancore or Cochin, though it is doubtless a resident species.

Egretta garzetta garzetta (Linn.). The Little Egret.

Specimen not obtained.

Noted at: Kōttayam and Karūpadanna (backwaters). Shoranūr (on Ponnāni river).

The Surveys found the Little Egret somewhat commoner than the two foregoing, but on the whole far from abundant. It was usually seen in pairs or small parties—on one occasion a flock of 6 or 7.

Breeding: Nothing appears to be recorded from our area.

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Bubulcus ibis coromandus (Bodd.). The Cattle Egret.

Specimen not obtained.

Noted sparingly along the railway line from Shoranūr to Chālakudi and in the low country of Cochin generally. Strangely enough I have no record of it from Travancore where Ferguson says (*J.B.N.H.S.*, xvi, 16) 'this is the commonest of the white egrets and may be found in numbers in all paddy fields throughout Travancore, along the backwaters and in cultivated land'. It would be worth investigating if the persecution I have referred to under *E. intermedia* may not have something to do with the discrepancy between Ferguson's account and my own recent experience of its status in Travancore.

Fairbank (*S.F.*, v, 410) records this egret from the base of the Palni Hills.

Breeding: Nothing recorded except Ferguson's statement that it assumes the breeding plumage about April. The birds must therefore evidently breed in Travancore at the commencement of the rains, as they do in most other areas of their distribution.

Demiegretta asha (Sykes). The Indian Reef Heron.

Specimen not obtained.

Noted at Karūpadanna, Ernākulam (backwaters).

Not common. Single birds were observed occasionally, perched on low fishing stakes and the posts marking the navigable channels in the backwaters. Ferguson (*J.B.N.H.S.*, xvi, 16) records that a single specimen was obtained by the Trivandrum Museum collectors at Ayrentenga, on the coast near Kāyankolum.

Breeding: Apparently not been recorded in Travancore or Cochin.

Ardeola grayii (Skyes). The Indian Pond Heron.

Specimens collected: 700 ♀ ad. 21-7-33, 775 ♂ juv. 3-8-33 Beach, Trivandrum.

Elsewhere noted at: Thattakād (200 ft.); Kōttayam (ca. S.L.); Kūmili and Periyār Lake Environs (ca. 3,000 ft.); Capè Comorin; along the railway line from Soranūr to Ernākulam; Kūriārkūtti (1,600 ft.—along Parambikolam river); Waddakkāncheri (400 ft.); Ponnāni river; Nemmāra (300 ft.); Karūpadanna (ca. S.L.).

Colours of bare parts: *Adult* (700): 'Iris yellow; bill marine blue at base, yellow at middle, black at tip; mouth chocolate brown; legs and feet pink; claws horny brown. *Immature* (775): Iris bright yellow; bill upper mandible blackish green, black at tip; commissure yellow; lower mandible greenish-yellow with a dark patch on either side near the tip; gape greenish-yellow; mouth bluish-flesh; legs and feet yellowish green; claws plumbeous.' (Pillai).

[Measurements:

	Bill.	Wing.	Tail.	Tarsus.
1 ♀ ad.	62	189	62	54 mm.
1 ♂ juv.	...	187	62	...

These two specimens are smaller than northern birds, but more require to be examined from Ceylon and South India before the possibility of there being 2 races can be settled.—H. W.]

The Pond Heron or Paddy Bird is a very common resident species throughout the low country of Travancore and Cochin and was also met with more sparingly in suitable localities up to at least 3,000 ft. elevation. It is found singly or in loose parties in the neighbourhood of streams, tanks, puddles and flooded paddy fields, both along the backwaters and farther inland.

In the Palni Hills, Fairbank (*S.F.*, v, 410) saw it by streams and ponds at the base.

Breeding: Mr. Pillai found the ovary of No. 700 (21 July) to be fully mature with the largest follicle measuring 12 mm. in diameter. The bird was undoubtedly breeding.

Nothing more seems to have been recorded in this area.

Butorides striatus javanicus (Horsfield). The Indian Little Green Bittern.

Specimen not obtained.

Noted at: Thattakād (200 ft.—Single on drift log in narrow wooded channel

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in Periyār river); Kūriārkūtti (1,600 ft.—Single among bushes on bank, overhanging Parambikolam river).

This Bittern is doubtless a resident species in our area, but its status is apparently somewhat indeterminate. In Travancore F. W. Bourdillon described it as a winter visitor, silent and solitary, and found from November to March among the rocks of the larger streams up to about 2,000 ft. elevation. Ferguson (*J.B.N.H.S.*, xvi, 16) found it common in the low country from November to April, but he did not meet with it at any other time of the year.

Breeding: In Travancore or Cochin, unrecorded.

Nycticorax nycticorax nycticorax (Linn.). The Night Heron.

Specimen not obtained.

Noted only at Shoranūr (North Cochin boundary)—a small colony roosting among vegetation overhanging the steep outscoured banks of the Ponnāni river, and flying out at dusk to feed.

Ferguson's collectors found this species fairly common at Perambulum in North Travancore and at other places round the Vembanād Lake where they are apparently protected by the inhabitants.

Breeding in Travancore or Cochin, unrecorded.

Gorsakius melanolophus melanolophus Raffles. The Malay Bittern.

Not met with by the Surveys.

Ferguson mentions (*J.B.N.H.S.*, xvi, 17) that F. W. Bourdillon obtained a specimen of the Malay Bittern on the hills at about 2,500 ft. elevation in 1878 and that subsequently he received 2 live specimens. Stewart seems to have found it common in Travancore (*Fauna*, vi, 362).

It has not been recorded from actually within the Cochin State, but it must doubtless occur there. Kinloch (*J.B.N.H.S.*, xxix, 294) obtained a specimen and found it common in the Nelliampathy valley. He also saw this Bittern at the foot of the Palghat Hills.

Breeding: *Nidification* (iv, 479) records that Stewart took many nests of the Malay Bittern in Travancore from the end of May to early July.

Ixobrychus sinensis sinensis (Gmelin). The Yellow Bittern.

Specimen collected: 417 ♂ 7-3-33 Kūmili 3,000 ft. (Periyār Lake).

Elsewhere not noted.

Colours of bare parts: Iris bright golden yellow; culmen horny brown; commissure and lower mandible pale yellowish-flesh; naked skin at gape under and around eyes pale greenish yellow; mouth pink; legs and feet greenish yellow; claws horny brown.

[Measurements:

Bill.	Wing.	Tail.	Tarsus.
68	139	47·5	51·5 mm.—H. W.]

The specimen was one of a pair among decaying bamboo root-clumps and brushwood in a swamp on the margin of Periyār Lake. When wounded, the bird got within a bamboo clump and stretching its neck and bill perpendicularly skywards, assumed the so-called 'On guard' attitude, standing perfectly motionless and making itself extraordinarily inconspicuous amongst the culms at 5 yards range!

Ferguson's collectors obtained several specimens of this Bittern in North Travancore where they reported it as being found solitary on the banks of the backwaters about Kōttayam and Vaikom (*J.B.N.H.S.*, xvi, 17).

Breeding: The testes of the specimen were in a quiescent state. Nothing recorded specifically for Travancore or Cochin.

Ixobrychus cinnamomeus (Gmelin). The Chestnut Bittern.

Specimen collected: 302 ♂ 17-2-33 Kōttayam (Munro Island, Vembanād Lake).

Elsewhere not noted.

Colours of bare parts: Iris bright golden yellow with a small crescent-shaped brown patch behind and half-encircling pupil; culmen horny brown; commissure and lower mandible greenish-yellow; mouth pink; legs and feet yellowish-green; claws horny brown.

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[Measurements :

	Bill.	Wing.	Tail.	Tarsus.
1 ♂	58	155	47	53·5 mm.—H. W.]

The specimen, a solitary bird, was flushed from amongst rank grass and decaying brushwood in a marshy patch in cocoanut and paddy cultivation.

According to Ferguson (*J.B.N.H.S.*, xvi, 17) this little bittern is common throughout Travancore on all the lakes and backwaters, frequenting the canals cut through the ground laid out for the cultivation of young cocoanut palms.

It is a resident species in Ceylon.

Breeding: The testes of the specimen were quiescent. No records of its nidification in Travancore or Cochin are available.

Dupetor flavicollis flavicollis (Lath.). The Black Bittern.

Not met with by the Surveys.

Ferguson (*J.B.N.H.S.*, xvi, 17) describes the Black Bittern as not uncommon along the backwaters in Travancore, frequenting the dense vegetation and screw-pine tangles on the banks of canals. He found it of crepuscular habits. Stuart Baker (*Fauna*, vi, 369 and *Nidification*, iv, 484) writes (on the same authority?) that it is comparatively common in Malabar and Travancore.

In the Palni Hills, Fairbank (*S.F.*, v, 410) says he twice came upon a Black Bittern when collecting ferns in the early part of 1867 below Vilpati. As no specimen was obtained by him and as he recognised the bird merely from the figure he had seen in Jerdon's Illustrations of Indian Ornithology, Pl. 16, this record must be accepted for what it is worth.

Breeding: Unrecorded from Travancore or Cochin.

ORDER: ANSERES.

FAMILY: ANATIDÆ.

SUB-FAMILY: CHENONETTINÆ.

Nettapus coromandelianus (Gmelin). The Cotton Teal.

Not met with by the Surveys.

In Travancore, Ferguson (*J.B.N.H.S.*, xvi, 18) believed the Cotton Teal to be a winter visitor only, and never abundant.

A. M. Kinloch (*J.B.N.H.S.*, xxvi, 674) saw four specimens which were shot near Kollengode, just outside Cochin boundary, at the end of 1918. He was informed that the species was not uncommon there.

Breeding: No record for this appears to be published.

SUB-FAMILY: ANSERINÆ.

Anser indicus Latham. The Bar-headed Goose.

According to Stuart Baker (*Fauna*, vi, 406) this Goose has been obtained in the Nelliampathy (Hills or Valley?) by Kinloch. No other information is available.

SUB-FAMILY: ANATINÆ.

Dendrocygna javanica (Horsf.) The Lesser or Common Whistling Teal.

Specimen not obtained.

Noted only at Kōttayam (February): 'A fair number amongst enormous flocks (several thousand) of mixed species, floating in masses on Vembanād Lake near Munro Island during daytime and feeding in the surrounding paddy fields at night. Much persecuted by gunners, and extremely wary.'

Ferguson writes (*J.B.N.H.S.*, xvi, 18): 'The Whistling Teal is common on all weedy tanks and lakes throughout Travancore. On one such piece of fresh water near Sāstancōttah, I saw hundreds in April 1902; but in December 1903, in the same place, not a single one was to be found. It is, perhaps, commoner in the North than in the South.'

Breeding: Nothing recorded from our area.

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Nettion crecca crecca (Linn.). The Common Teal.

Specimen not obtained.

Noted only at Kōttayam. A few amongst the masses resting on the surface of Vembanād Lake (February). Ferguson (*J.B.N.H.S.*, xvi, 18) shot a single specimen of this teal in South Travancore. It is of course only a winter visitor.

Querquedula querquedula (Linn.). The Garganey or Blue-winged Teal.

Specimen not obtained.

Noted only at Kōttayam. The majority of massed wildfowl resting on the Vembanād Lake were undoubtedly this species. Here they were much harassed by local sportsmen and were, in consequence, excessively shy. The birds had studied to a nicety the art of keeping just out of shot-gun range. When approached closer, and unless fired at, those at the outer margin of the mass merely 'hopped' a few yards deeper into it, and so on continuously! Our motor boat passed 2 or 3 putrefying birds of this species floating on the water in the neighbourhood which had doubtless died of shot wounds.

Ferguson (*J.B.N.H.S.*, xvi, 18) says: Large flocks may be met with on the backwaters in North Travancore in winter.

Among the flocks, I think there were also a certain number of Gadwall (*Chaulelasmus streperus*), but owing to the distance this could not be definitely verified even with powerful field glasses.

Sub-Family: Nyrocinæ.

Nyroca rufa rufa Linn. The White-eyed Pochard.

Specimen not obtained.

Noted at Kōttayam. I am almost certain that a large number of birds comprising the masses of wildfowl on Vembanād Lake (February) were of this species. Strangely enough it has not been previously recorded from Travancore or Cochin.

ORDER: PYGOPODES.

Podiceps ruficollis capensis Salvadori. The Indian Little Grebe.

Specimen collected: 550 ♀ 9-4-33 Cape Comorin ca. S.L.

Elsewhere noted at Nagercoil.

Colours of bare parts: 'Iris yellow; bill black above, green at gape, dull yellow on lower mandible, tip white; legs and feet black with greenish webs; claws whitish.' (Humayun Abdulali).

[Measurements: Bill 23, Wing 96, Tail 23, Tarsus 32 mm.—H.W.]

Pairs or small parties of the Little Grebe were observed on village tanks in South Travancore. They were not common.

Breeding: According to Ferguson (*J.B.N.H.S.*, xvi, 18) it breeds in Travancore in August.

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[THE END].

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BIRD LIFE ON A SOUTHERN INDIAN TANK.

BY

F. N. BETTS.

(With two plates).

Waterfowl make a small showing in the list of Coorg birds owing to lack of conditions to suit them in the hilly country which comprises most of the area of this little province. Natural lakes there are none and the artificial tanks which are such a feature of the landscape in the plains are few and small and confined to the narrow strip of dry, low-lying country between the hills and the river Cauvery which here forms the Mysore boundary.

There is one however of considerable size which has long been a favourite haunt of mine. It lies between two low ranges of hills running north and south at a distance of a couple of miles, the furthest outposts of the Ghats. The more westerly of these, which is the higher, is buried from foot to summit in unbroken jungle except where the dominating peak of Jainkalbetta thrusts a bald head above the trees, while its counterpart is a mere ridge of rocky outcrop hardly a hundred feet high, sparsely grown with thorny scrub and a few stunted trees which have managed to gain a foothold in pockets of soil among the black stones. A shallow vale separates the two, mostly open maidan interspersed with patches of scrub, merging at its upper end into the jungle and at the lower cut off from the tank by a belt of trees, bamboos, date palms and tall banyans and tamarinds, the lantana growing thick about their bases making an almost impenetrable barrier except where the cattle tracks pierce their way.

My first visit was on an afternoon in July. There was a lull in the monsoon and though the main ranges on the western horizon were veiled in mist, here on the edge of the dry zone the clouds had thinned to allow a watery sun to gleam through, and a few miles further east the sky was clear. The maidan was vivid with the green of young grass, cropped to a short sward by the hungry grazing of herds of scrubby cattle, which even in this season of plenty looked gaunt and half-starved. The lantana growing in great clumps lent, pestilential weed though it is, much to the beauty of the scene as it was in full flower, and the masses of bloom smothering the bushes made broad splashes of orange and pink. The tank was at its fullest. It is a rough crescent half a mile in length with a high bund all along the concave face. Two-thirds of the way along the opposite shore the regularity is broken by an arm of swampy ground where once a feeder ran in but this has long since silted up though it is still moist enough to provide luxurious wallows for pig and buffaloes. Indeed the whole tank is much smaller than it must have been at one time for even in the wettest seasons a broad strip of rough herbage lies between the belt of trees and the water. The tip of one

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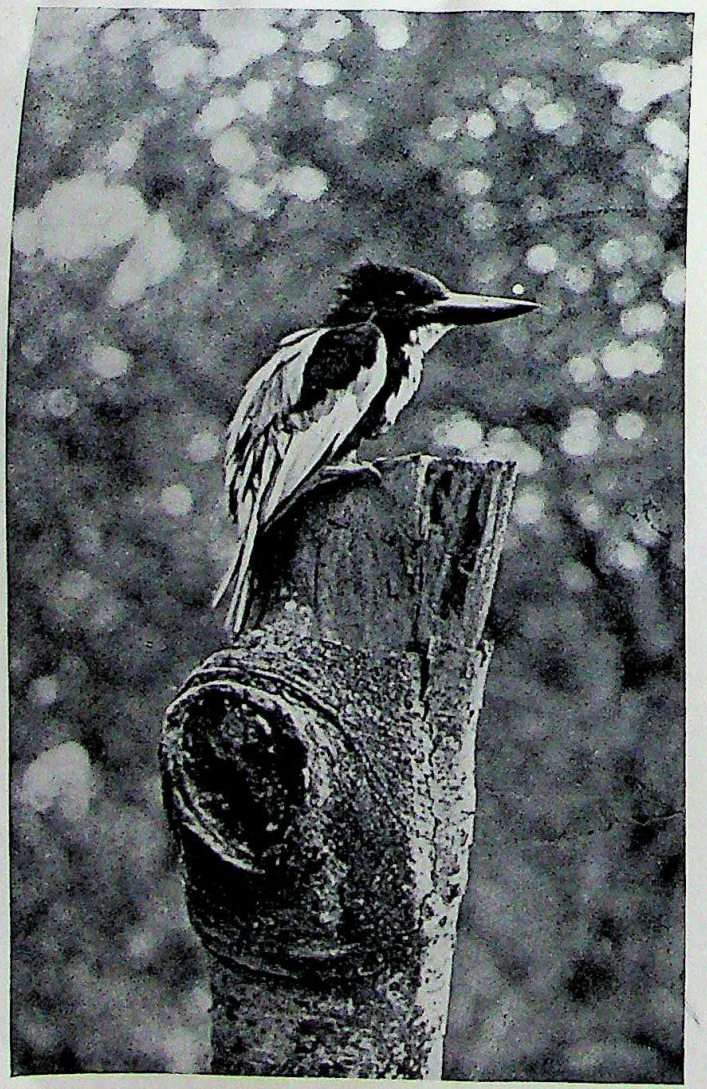
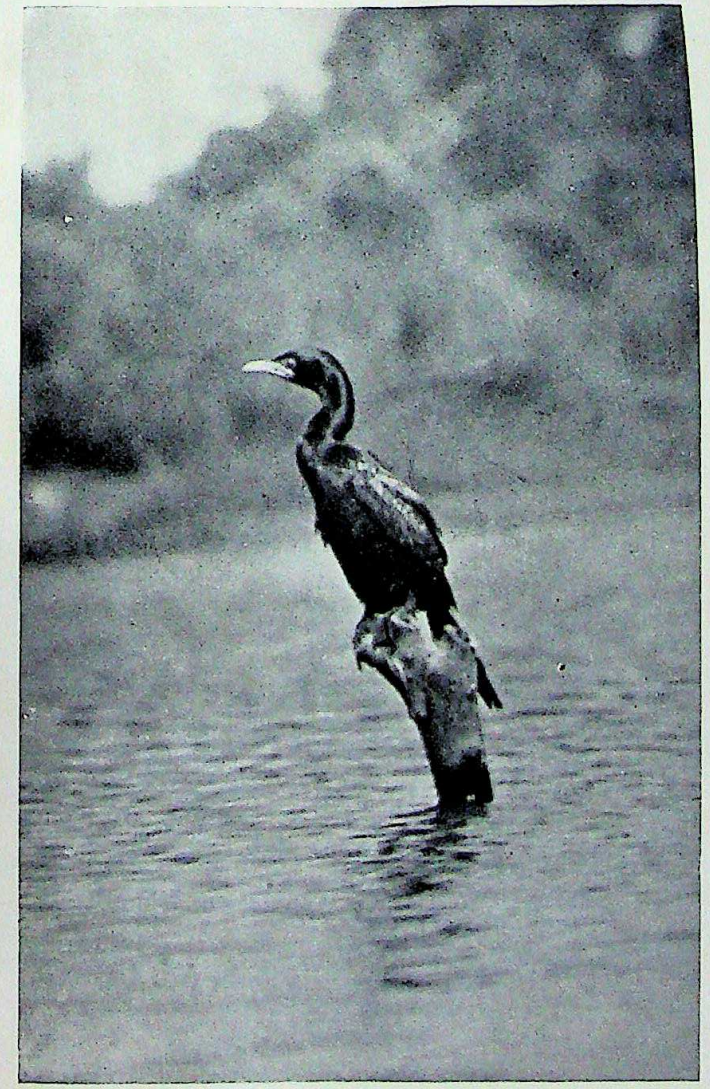


White-breasted Kingfisher.
(*Halcyon smyrnensis*)



Little Cormorant.
(*Phalacrocorax niger*)

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horn runs right up to the jungle of the western range and here the elephants come down to drink in the hot weather when water is scarce, leaving the shore pock-marked with their enormous footprints. This end where the water is shallowest is all overgrown with beds of bulrushes but as it gets deeper these thin out and grow in smaller patches and the sheets of lotuses and other weeds which spread beyond them disappear within a few yards leaving several acres of open water.

Bird life is abundant and undisturbed except by an occasional fisherman for though the cattle water here, the paddy fields below the bund have been abandoned for many years and the nearest village is several miles away.

By far the most numerous of the waterfowl proper are the dabchicks. At least a dozen pairs have a permanent home on the lake and in July breeding is in full swing. I have found as many as six nests with eggs in one day and must have missed numbers more in the heart of the reed thickets. Most are built just inside the outer edge of the bulrush beds but occasionally they are out in full view in the middle of the open water anchored to a patch of floating weeds. They are all much the same; floating platforms of rotten waterweed about a foot in diameter. The eggs are covered as soon as the first one is laid with a heap of weed which is replaced whenever the bird leaves the nest. She is extraordinarily quick at doing this and only once have I managed to flush one before she had time to hide her eggs. A few deft movements of her bill and she dives over the edge leaving only a ring of ripples to betray her connection with what looks like a casual accumulation of rubbish. She comes up at a safe distance and tries to create a distraction by frantic splashings and flappings. During much of the day the eggs are left to themselves, the heat generated by the decaying materials of the nest being quite sufficient to keep them from getting chilled.

When incubation has started, the dabchicks are quiet birds, but earlier in the month, while courtship is going on, the lake resounds with their long trilling calls as the pairs dive and come up face to face and rub bills or chase each other half flying, half swimming across the water. Once on the wing, they fly strongly, but except at this season or when changing quarters, seldom do so. In their breeding plumage they are almost handsome, the dark chestnut of the throat and sides of the neck contrasting with the sombre brown of the rest of the upper plumage. At the best of times however their broad, rounded, almost tailless sterns give them a barge-like appearance as if built more for utility than for show or speed.

Most of the first broods are hatched off by the beginning of August. Although the normal clutch is three or four, even occasionally five, it is rare to see more than two of the little stripey chicks with the mother. The male seems to take but little interest in them. Though perfectly capable of diving when alarmed, the young at first do not feed themselves but swim round anxiously while their mother disappears under water and brings them up scraps of weed and little fishes. Within a few weeks they are

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full grown and independent, only their dull colouring distinguishing them from their parents who are by now busy with a second family.

Moorhens are not numerous in the rainy season though one or two pairs breed every year, building substantial nests of dead reeds among the bulrushes. They are the aristocrats of a plebeian family; quiet, well-conducted birds soberly but smartly clad in dark grey with touches of white set off by a scarlet frontlet. They are excellent swimmers, though no great divers and spend most of their time on the water paddling jerkily among the lily pads, sitting high and gracefully, stern cocked and constantly flirted to display the gleaming white of the undertail coverts. An occasional loud 'karuck' announces their presence but except during the squabbles of the courting season they are far from noisy.

The Purple Coots on the other hand are thorough vulgarians. For all their gaudy plumage of purplish blue they have a coarse, ugly appearance and a temper to match. Each bird has his private domain, invasion being strongly resented, and the peace of the lake is constantly disturbed by their noisy brawls. They favour the reed beds or where the lilies grow thick enough to support their weight for they do not swim more than they can help and usually take wing to cross an open stretch of water, flying low and heavily with legs trailing. They love to scramble to the top of a clump of reeds, which bow and bend ominously beneath them, to bask complacently in the sunshine, quite careless of the insecurity of their perch. Their numbers vary greatly; in some years there may be twenty or thirty and in others none at all. They may be seen at all seasons but I have never found them breeding on the lake.

Common coots are only occasional winter visitors and the only other conspicuous members of the Rail family are the White-breasted Moorhens. They are inveterate skulkers and it is their voices that give them away. They only leave the sanctuary of the thickest reed beds to feed along the shore when they are quite certain that the coast is clear and at the first alarm scuttle back into cover or fly up into a thick tree, for they are more arboreal than most of their relatives and often nest at considerable heights above the ground. From their lurking places they send forth weird and uncanny bellowings and caterwaulings quite unlike any other bird notes.

A pair of these were the actors in one of the most delightful vignettes of wild life that it has been my luck to witness. I was sitting by a small waterhole in the heart of the jungle when the silence was rent by a hair-raising clamour as of some large beast in dire extremity. Presently out from under the bamboos marched a little procession, a white-breasted moorhen followed by three newly hatched chicks like balls of black swansdown, while bringing up the rear came the other parent. The old birds stalked cautiously along keenly on the alert for danger, tails stiffly cocked to show the bright chestnut underneath, a flag to guide the little ones as they scrambled valiantly through the rough grass. They were shepherded into the security of another bamboo clump, whence after loud celebration of their safe arrival, one of the parents ventured

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Nest of Striated Weaver Bird, (*Ploceus manyar*) "Helmet" Stage.

Nest and eggs of Dabchick (*Podiceps ruficollis capensis*).

Photos by Author.

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forth to forage on the margin of the pond to return triumphantly with a large worm in its beak.

The Bronze-winged Jacanas are very conspicuous members of the population, with their bright plumage and voices second only in power to the white-breasetd moorhens'. They must mate for life as they are always to be seen in pairs. They are admirable examples of specialised development, their toes and claws being enormously lengthened, enabling them to run swiftly and easily over the floating lily leaves, where other birds of their size would sink or flounder awkwardly. Seen thus or swimming buoyantly across the lanes of deep water they are strikingly handsome reminding one of those strange, brilliant birds to be seen on a Chinese screen. On the wing they do not show to advantage though they fly freely and well; their stumpy tails and long legs with the enormous feet trailing behind them give them a singularly unbalanced appearance. Like most of the waterfowl they are monsoon breeders and in early July are in the full ardour of courtship. The males bow and strut before their mates calling excitedly, drooping their wings and elevating and exhibiting the bright maroon feathers of the rump.

The ducks are confined to the two resident species, the Cotton Teal and the Lesser Whistling Teal. A small flock of the former are usually to be seen feeding among the floating weedbeds on the edge of the open water, keeping up a continual conversation in low, gabbling tones. Though they can dive like dabchicks when wounded they seem to be entirely surface feeders and I have never even seen them up-ending in shallow water after the fashion of domestic ducks and most of the wild, non-diving species. They must surely breed in the big trees round the tank but I have not been able to find a nest nor have I seen any young on the water and even in the rains when the drakes are in full plumage they are usually accompanied by their mates. At this time of year the drakes look very white and on a dull day show up as brilliantly as gulls at a distance where the ducks are quite invisible. They are great home-lovers and at a duckshoot are the last to leave, flying round and round low over the water long after the Grey and Whistling Teal have departed.

One or two pairs of the latter frequent the tank throughout the year but their numbers vary and I have yet to discover them breeding in the vicinity. They are much warier than the Cotton Teal and have a perennially anxious air. At the first hint of danger up go their long necks and they paddle hastily out to the middle of the open water. A couple of shots is enough to set them circling to gain height and be off to the next water. On the wing they are like no other duck with their slow unhurried wingbeats and peculiar mewing cries which they seem never to utter at other times.

In the monsoon, the Heron tribe are conspicuous by their absence but ever since I have known the tank there has been one solitary Small Cormorant whose favourite perch is a dead log sticking up in the middle of the water. There he spends hours together basking and hanging out his wings to dry in the

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intervals of his fishing. His right to his favourite seat is seldom disputed but on one occasion when a Snakebird paid the tank a visit he had to give way to his larger relative albeit with a very bad grace and the moment the latter departed he was back again.

Kingfishers are always in evidence and one or two pairs of the White-breasted and Common Indian Kingfishers are resident. The former obtain as much of their food on land as on the water and are fond of taking up a stance on a tall bamboo on the edge of the jungle where they can keep watch for lizards and large grasshoppers in the short grass of the dried-up margin. Pied Kingfishers often come in from the Cauvery which flows only three miles away but do not linger long. Their hunting methods are those of the trout fisherman rather than the bottom angler, for unlike most of the family they go to seek their prey instead of waiting for it to come to them. The Pied Kingfisher rivals the kestrel in mastery of the art of hovering. The little Indian kingfisher does this sometimes but with the former bird it is the normal habit. It quarters the water systematically, coming up into the wind at every few yards and hanging on rapidly moving wings, head sunk between the shoulders and bill pointing downwards as it scans the surface below. If there is anything worth a closer examination it drops a few feet vertically with a jerk as though let down on an invisible string, hovers again for a second to make sure and then turns over and plunges headlong with half-closed wings. A small object like a tadpole may be swallowed in the air but anything larger is carried off to a perch and hammered into subjection in the usual way before being devoured.

While one or two colonies of bayas breed annually in the date palms in the tree belt separating the tank from the maidan, it was only this year, 1936, that I found their near relatives, the Streaked Weavers, in residence. They are common enough on the Mysore tanks and it is probable that the poor monsoons of the last three years which have left many of these practically dry, have driven them beyond their usual beat. The bayas like to build over water if they can but their nests are always in trees and may be found well away on dry land provided there are paddy or ragi crops at hand to provide building material. The Streaked Weavers are more particular, and in this part of India at any rate, nest exclusively in reeds in standing water. Breeding starts early in July as soon as the reeds have reached their full height. The cocks are the first on the scene and at once begin building. They appear to assume breeding plumage very irregularly, many of those hard at work showing but little of the golden cap of full dress though whether this is assumed afterwards I am unable to say. The hens arrive later and only begin to take interest in the nest when it is nearing completion. Streaked Weavers' nests are much smaller than those of the baya and are not suspended on a long neck while the entrance tunnel is seldom prolonged for more than six inches. A start is made by binding twenty or thirty reeds together about a foot from their tips, and on this foundation is woven a very strongly twisted loop of grass or rather

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strips of reed about 1/16th of an inch in width. These are ripped off the bulrush leaves and apart from mud are the sole materials used. Work proceeds in very definite stages, there being often a pause of several days between each, for it is common to see part of the nest withered brown while the new section is still fresh and green. The second stage is to weave a dome on one side of the loop leaving the bottom open. At this point the nest resembles a helmet with chin strap, very neatly finished off with no loose ends hanging about. Weaving is temporarily suspended while a band of mud half an inch wide is plastered all along the nape of the helmet. Until the mud is dry no more is done and many nests for some reason or other get no further than this being either simply abandoned or else cut down and dropped into the water below by their dissatisfied builders. All being well however the bottom of the dome is next filled in forming an egg-shaped purse, the loop making the entrance. It is only after the eggs are laid that the tunnel is built onto the latter and is lengthened sporadically until the young hatch.

When I first saw the colony it was confined to six or seven nests in one small patch of reeds but by the end of August it had extended to almost every reedbed in the tank and there must have been thirty or forty occupied nests, never however more than half a dozen close together, and many more in an incomplete state.

An interesting feature was the association of black-headed munias with the weavers. The shores of the tank are a favourite resort of this family of small, brightly coloured finches. At one time or another I have seen all the six species which occur in this area feeding in mixed flocks in the herbage round the water's edge. The black-headed munias, in their rich chesnut, black and white are much more water-loving than the rest. A few have always nested in the bulrushes. As soon as the weavers arrived and started breeding one or two pairs of the munias took to haunting each group of nests, hopping about among their larger relatives, and even settling on the nests themselves I never saw them go inside nor had they laid eggs in any that I examined so that there seems to be no question of parasitism, but it was certain that as the weavers increased in numbers so did the munias until there were far more than I have ever seen there before. The Weavers took no notice of them whatever and apart from this consort at the nesting site the two species had little in common, the Munias feeding separately or joining flocks of other munia species. About three weeks after the first weaver's nest was completed, the munias started breeding operations on their own, making their roughly-built, untidy balls of rushes and grass low down in the reeds only a foot or so above the water, sometimes in the middle of a weaver colony but usually in a separate clump a few yards away. As with most munias the nests are lined with green grass stems, the flowering heads projecting in a frill round the entrance. It seems likely that the true weavers must have evolved their elaborate nests from something very like these primitive structures, gradually learning to split the coarse reed leaves into narrow strips more easily

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workable and developing the fringe round the doorway into a completely enlosed tunnel.

A visit to the tank in February or March finds a very different scene and its bird population has quite altered in character. It is at the end of the dry season before the first showers and the sun is daily increasing in strength. The maidan is sere and brown where it has not been blackened by forest fires. The jungle is a bright yellow from the dead leaves which still hang on the bamboos but most of the trees stand gaunt and bare. The only relief from the prevailing black and yellow are the brilliant splashes of scarlet where the Flame of the Forest is in flower. The belt of trees near the water however is still green and all the bird life of the neighbourhood seems concentrated in their shade. The tank has shrunk to half its size and the reeds stand up withered and dead where the water has receded beyond them. Here and there small islets and mudbanks appear, the favourite basking places of turtles and an occasional small crocodile. The waterfowl have now no family cares and lead an idle life. Times are hard for the larger beasts of the jungle but for them food is plentiful and easily obtained. The dabchicks are in their dull winter plumage but as noisy as ever. The moorhens' numbers have been increased by migrants and sometimes a small flock of Coots pay a fleeting visit. The migrant duck and teal seldom come here; they prefer the larger tanks. The heron family are in force. Pond herons by the dozen parade the water's edge, frog-hunting, almost invisible in their drab plumage until they take flight when their white wings flash out from beneath the long concealing coverts in startling fashion. The egrets on the other hand make no attempt at disguise, the dazzling purity of their dress shining from afar. Cattle egrets in small flocks wander about among the grazing buffaloes picking at the ticks and flies that infest them while the other species keep to the water, standing knee-deep, motionless except for an occasional dart of the bill as they spear a fish. In what is left of the reedbeds skulk chestnut bitterns and little green herons. They are difficult to flush and when they do take wing it is only to flop back into cover a few yards on. The reeds, too, often hold a Purple Heron, whose snakey neck is craned above the tops at the sound of approaching footsteps to be followed by a threshing of great wings as he hoists his bulk awkwardly from the ground until, free of entanglement, he tucks up his long shanks, coils his neck back on his shoulders, and wends his stately way to the far end of the lake with a croak of protest at being thus startled out of his accustomed dignity. Rarely an Open-Bill Stork comes in from the Cauvery and stalks proudly among the lesser fry or stands contemplative on one leg on the topmost branch of a dead tree.

There are other less harmless visitors. The waterfowl care little for the Brahminy Kite, the most brightly coloured of all the birds of prey, as he soars and swoops on effortless pinion overhead, for he is a coward and a scavenger though ready enough to make off with a wounded bird. The Marsh Harrier who comes down from the north for the winter meets with more respect. When

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his slim, long winged shape comes winging low over the reedbeds, quartering the ground with the persistency of a setter, the dabchicks dive hastily and the moorhens and cotton teal scutter into covert or freeze immobile where they sit. Worse still is the Shahin Falcon who has a hungry brood clamouring for food in their eyrie on the crags of Jainkalbetta. On her approach a death-like silence falls on the scene and woe betide the foolish teal or coot who happens to be in the air when she appears. The tank lies within the beat of a pair of grey-headed fishing eagles but their eyrie is on another stretch of water seven or eight miles away. Serpent eagles are common in the neighbouring jungles in so far as the larger birds of prey can ever be said to be common and find the shores where numerous ratsnakes and monitor lizards come out to bask a profitable hunting ground. I have never seen these birds tackle a really large snake though doubtless they are quite capable of doing so and they are by no means too proud to make a meal off the vulgar Bullfrog when nothing better offers.

The great Wader order is well represented in the dry weather by a number of winter visitors, the only resident species being the red-wattled lapwing. One or two pairs of these handsome, long-legged plover breed round the shores of the tank and lay their first eggs about the beginning of April. While they have eggs they are very inconspicuous and leave the vicinity unobtrusively at the approach of a human being, but during most of the year they are the self-appointed watchmen of the community, being the first to spot any possible danger and warning all the other birds with their clamorous, 'Did he do it, Dick did he do it.' When they have young their anxiety and noisiness are intensified. Screaming dementedly they swoop round the head of an intruder or flutter helplessly along the ground, playing the old broken wing game and continue their demonstrations until he is well off the premises.

Pintail snipe in small numbers lie up for the day in the reed-beds, and seldom show themselves till dusk but the green Sandpipers are much bolder and more numerous. They trip daintily along the waters's edge, pausing now and then to bob on a stone, or skim lightly across an arm of the tank, flying low over the water, each sharp wing stroke followed by a long glide, displaying the white rump which is their distinguishing feature. Unlike snipe they demand actual standing water for a feeding ground, mere damp marshland is not enough for them. They wade boldly and will often swim across a channel of deep water too narrow to be worth the trouble of taking to the air. They are unsociable birds usually solitary and rarely to be seen more than two together. The smaller wood sandpipers on the other hand while they do not gather in regular well-drilled flocks as do so many of the smaller waders in winter like the company of their kind and form loose associations of twenty or thirty whose members while feeding and moving independently keep in fairly close contact.

At this time of the year bee-eaters are much in evidence and this is the only spot in Coorg where I have come across the

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Blue-tailed Bee-eater. This species is common on the West Coast where it is almost a seabird, hawking far out over the estuaries and backwaters often at a considerable distance from land, but in the interior it is very local. Much more numerous is the little Common Bee-eater. Even in the rains a few may be seen round the tank but these are all immature birds. The old ones migrate during the summer months probably eastwards beyond the range of the monsoon. Both these species and sometimes the Chesnut Headed Bee-eater, distinguishable by its lack of the prolonged, needle-like central pair of tail feathers, breed on the tank shores, for, unlike the Kingfishers they do not require a vertical bank in which to burrow but are content to sink their shafts in almost level ground provided the soil is sandy and easily workable. Eggs are laid in April and a month later it is a pretty sight to see the young families perched in rows on the bamboo fronds twittering excitedly as their parents bring them the bees and dragon flies that they hunt so adroitly.

While the birds that I have mentioned are the most conspicuous frequenters of Halagote and its surroundings, they are of course not a tithe of the numbers that may be seen there especially in the dry weather when other water is scarce. At various times, practically every species that occurs in the neighbourhood may be seen there, and the probability of meeting something new and unexpected lends excitement to each visit.

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REVIEWS.

MANUAL OF THE MAMMALS OF CEYLON by W. W. A. PHILLIPS, F.Z.S., M.B.O.U., Ceylon, The Director of the Colombo Museum; Dulau & Co., London. Price Rs. 10, in England 15s.

All sportsmen, naturalists and zoologists interested in the Fauna of British India will welcome this admirable and much-needed volume on the Mammals of Ceylon. The collecting of the species necessary for it and the observations of their habits in the field have occupied for many years most of the leisure hours Mr. Phillips could spare from other duties. During that period dating back to the conclusion of the Great War he published from time to time many papers on interesting specimens he secured and he kept in continual touch with Messrs. Thomas, Hinton and Wroughton in the British Museum, sending them specimens for identification and description and enriching the national collection with many freshly collected skins of which it was greatly in need.

The Fauna of Ceylon has an interest all its own wrapt up in its past geological history and its former connection with Peninsular India and subsequent severance from it. Very appropriately Mr. Phillips leads off with its story in his introduction. Here too its physical features are described and these are illustrated by a coloured map showing the dry and wet zones, the central hill ranges, river systems, etc. and also the recently established Game-reserves. The main portion of the volume dealing with the characters and habits of the different kinds of the mammals is handled in the most approved style. It opens with the Monkeys and closes with the Pangolins and nearly one-third of it is taken up by the Rodents. Analytical keys presenting the most striking and obvious differences between the various groups are supplied for their ready identification and all the principal species are illustrated by excellent photographs of the living animal, sometimes depicted in its natural haunts. In addition there are well-drawn figures of heads introduced into the text to show features that escape the camera and, although cranial characters are not especially dealt with in the volume, very good drawings of the skull of the most important types have been wisely inserted. At the end of the volume there is a useful bibiliography, followed by indices of the English, Sinhalese, Tamil and scientific names of the animals.

We cordially congratulate Mr. Phillips on the general excellence of this Manual and are grateful to him for it. It will for many years be regarded as the standard work on Ceylonese Mammals.

R. I. P.

A GUIDE TO COLLECTING BUTTERFLIES OF INDIA. By LT.-COL. H. D. PEILE. Published by John Bale Sons & Danielsson, London. Price £1-5. Size $8\frac{5}{8} \times 5\frac{7}{8} \times 1\frac{1}{2}$. Pages xiii-312: 25 plates (1 in colour).

The book commences with a coloured plate preceding the preface by Mr. N. D. Riley, Keeper of Entomology in the British Museum and lately Assistant Keeper of their butterflies. Then follows a brief introduction by the author: a comprehensive list of contents arranged alphabetically: a list of references and abbreviations: two pages of corrigenda: a 'Guide to Collecting Butterflies of India' (19 pages): brief descriptions of over 600 forms of butterflies (203 pages): lists of species from various localities (60 pages): a full index of specific and generic names: and the uncoloured plates (255 figures in all).

In the preface, Mr. Riley explains that the object of the author is to provide a handy volume, not aiming at completeness, but rather at an introduction to the study of such of the butterflies of India as are ordinarily met with. The book certainly fulfils its object: the guide is simple and complete and the plates are excellent. The remarks made below are not written in a spirit of adverse criticism, but with the object of suggesting improvements

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for embodiment in a subsequent edition, which will, it is hoped, be required soon, since a handbook more or less of this type is a real necessity for collectors in India. The price of the volume seems unduly high, when compared with that of other similar works, but this we understand is not the author's fault.

The long list of corrigenda is unfortunate and, it is feared, not complete: for instance '*Oclodes*' on page 222 should be '*Ochlodes*' and it is to be noted that this name is not included in the index.

The excellent 'Guide' calls for very few remarks. On page 1, the distinguishing features of the various Families would have been better arranged in the form of a key. The statement on page 4 that common ancestry is an important factor in the case of Mullerian mimicry is contradictory: probably the author had in mind a Mullerian association of closely allied species. On page 6, something might have been said regarding the symbiosis between ants and Lycaenid larvae. Instances should have been given in support of the assertions on page 9 that androconial scales vary with the season and that some Lycaenids are tailed at one season and not in another: none are known to the reviewer. The statement on page 9 regarding tibial spurs is incorrect, though correct on page 20. In speaking of tails on page 12, mention might have been made of the apparent protection they afford to Lycaenids, where they emanate from eye-like ocelli, inducing an enemy to regard the posterior end of a butterfly as the insect's head. Migration finds no place in the 'Guide'.

The selection of butterflies for inclusion in the main portion of the book was doubtless a difficult matter, but the results are decidedly 'patchy'. Of the 381 species dealt with the majority are such as were personally known to the author, who collected principally at Mussoorie, Peshawar, Bannu, Miranshah and Fatehgarh. Consequently for the plains of N. India, the West Himalayan hill stations and the N.-W. Frontier Province most of the species that occur have found a place and the author's observations regarding them are of interest. Odd species from Ceylon, S. India and the higher Himalayas are included, but Darjiling and Assam have been left out in the cold, and the book will be of very little use to collectors in these places. Rare species such as *Everes moorei, Euchloë belemia, Vanessa atalanta* and *Argynnis clara* have been included, while such common species as *Papilio crino, Cepora nadina, Nacaduba dubiosa, Arhopala centaurus, Udaspes folus,* the *Notocryptas* and *Pelopidas guttatus* and *bevani* have been omitted. *Mycalesis neavisala* (page 84) is not a species. On page 47 a new name, *tochica,* has been coined for the Tochi form of *Pieris rapae,* but the description is very scanty.

The genus *Papilio* has been divided into subgenera, a system, which, if required at all, should have been adopted elsewhere. The author has made an effort to bring the nomenclature up to date, but does not emphasise the changes sufficiently: for instance collectors in India will have a shock when they realise that such an old friend as *Belenois mesentina* is now aclled *Glycestha aurota.* Opinions on specific identity, such as are expressed on pages 65-69 and 171 regarding the species of *Colias* and *Lycaenopsis kollari* are out of place in a work of this nature.

The descriptions for the most part have been given under the title of 'Key': most of them have been taken from keys arranged as keys, but when substituted for descriptions they are apt to be confusing. For instance the beginner will find it difficult to distinguish the species of *Lampides* (page 184): *bochus* and *celeno* are keyed as having the fourth transverse band from the base ending on vein 3, but the corresponding position is not given for *cleodus* and *alecto,* while in the case of the latter species the key only deals with the difference between the subspecies. For *Lampides* the plates will help towards the solution, but for the next genus, *Nacaduba,* there are no figures and it is feared that the beginner will be quite helpless.

For the next edition it is suggested that subspecies should be omitted altogether and more species included. At least one species of each genus should be figured and the descriptions of the species confined to divergences from the figures. In this connection it may be noted that three species, looking almost exactly alike, of the genus *Aulocera,* are figured, while there are no figures at all of *Prioneris.*

The local lists will prove useful. Rhe. Philippe's lists for Lahore and Simla might have found a place, while the lists for Cachar, Manipur, the Naga Hills, Chin Hills and Ceylon, might well have been omitted as the majority of species therefrom are not dealt with in the book.

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There is no index for trivial names and the inclusion in the index of names from local lists seems unnecessary.

The plates have been drawn by the author and are excellent for the purpose. Figure 85 represents *loha* and not *padma*. Figure 107 looks more like *zeroca* than *selenophora*. Figure 171 of *lohita* more nearly resembles *syama*. Figure 226 of *maha* lacks the diagnostic spot in the forewing cell. Figure 200 *huegelii* is repeated as figure 213. Figure 247 probably represents *subochracea*, and not *mathias*, which has a dark brand.

To sum up, the 'Guide' is excellent and the plates are very good: the descriptive portion of the work would have been better had the included species been more carefully selected.

W. H. E.

March 4, 1937.

A BEAST BOOK FOR THE POCKET. By Edmund Sandars. Pp. 378. London: *Oxford University Press*; 1937. Price 7*s*. 6*d*.

This excellent book deals with the Mammals, Reptiles, and Amphibians of the British Isles.

'After preliminary articles on each Class, Order, or other group the plan of the book is to treat each species separately, giving: (1) the English name; (2) the scientific name; (3) the habitat; (4) a general description of the visible form, indicating the characters which distinguish it from other species; (5) a general idea of the teeth; (6) of the limbs, and (7) of any notable peculiarity of internal structure; (8) its life history, the young, their number and development; (9) its yearly life as affected by the seasons; (10) its daily life, including manners and behaviour; (11) food; (12) gait, on land, in air or water, and (13) its voice. A heading "Varieties" is added for the record of albinism or similar oddities and for such local races as have been distinguished as sub-species.'

'In the case of a domestic animal the heading "Habit" is replaced by a reference to its "origin", so far as anything is known, and to its "uses" to Man,: while the heading "varieties" covers the "breeds".'

The book contains some 215 illustrations distributed on 96 coloured plates, and nearly 200 line drawings interspersed in the text. The latter are surprisingly good; and the small maps showing the distribution and the numerical density of each species are particularly welcome.

The notes on the teeth and the gait are excellent; and many will delight in the sketches exhibiting the 'paces' of animals, their tracks and their footprints.

For the scientific names the author follows the so-called Trinomial System of nomenclature; but by an ingenious device of squaring and cubing he avoids repeating the same word twice or thrice. Thus *Meles*^{3} stands for *Meles meles meles*, *Mustela putorius*^{2} for *Mustela putorius putorius*, and *Vulpes*^{2} *crucigera* for *Vulpes vulpes crucigera*.

The only jarring sound is that of the Preface, written in a tone so apologetic as to become irritating. Quoth the author: 'My work has been to collect, compress and as the French say, to "vulgarize",' . . . Why drag the French in when the Oxford Dictionary has: *Vulgarize* 2. *trans*. To make common or popular; to reduce to the level of something usual or ordinary, 1709, and *Popularize* c. To present (a technical subject, etc.) in a popular form, 1836.

J. F. C.

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NOTE

ON THE BURMA WILD LIFE PROTECTION ACT.

During the August Session of the Burma Legislative Council the Burma Wild Life Protection Act of 1936 was, after consideration, referred to a Select Committee, and after some revision, passed without opposition. The Act extends to the whole of Burma. Under Section 28 the Government has power to draw up rules under the Act.

Its prescriptions allow of the declaration as a sanctuary of any land which is at the disposal of Government, and, subject to the consent of the owner and to such conditions as may be determined by mutual agreement, any land which is private property. Within a sanctuary no person is permitted—

Sanctuaries

(*a*) to hunt without the special permission of the Local Government which is only granted for scientific purposes, or to preserve the balance of animals, or

(*b*) to drive, stampede or wilfully disturb any animal. (Sections 3 and 4.)

Section 5 lays down that no person shall hunt, drive, stampede or wilfully disturb any animal or remove any animal or part or product thereof from a reserved forest except under a license.

Reserved Forests

Outside sanctuaries and reserved forests certain animals are declared:—

Other land

(*a*) Completely protected—rhinoceros, tapir, argus pheasant and masked finfoot,

(*b*) Protected—elephants, bison, *saing, thamin,* serow and goral, or

(*c*) Protected during certain close seasons.

(*a*) *Completely protected animals* can only be hunted under conditions of a special license issued by the Local Government for scientific purposes and no person may possess, sell or buy them alive or dead, or any part or product of them with the following exception. Any physician or druggist may possess or sell, or any person may possess for private medical purposes rhinoceros blood or any preparation thereof. This exception is a blot on an otherwise excellent Act, but it was essential for the reason that so many people in Burma have an implicit faith in the efficacy of rhinoceros blood for medical purposes. Had this exception been omitted, the Bill would probably not have been passed. In the past, although possession and sale of rhinoceros blood has been illegal, it has rarely been possible to prosecute the small country physician or the private person who may have possessed small quantities for medical purposes. It is doubtful whether much, if any, of the product known as rhinoceros blood is genuine. The prohibition against hunting and killing, or possessing or selling of

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parts and products of rhinoceros is, with this exception, absolute and it is hoped that the new Act will render poaching more difficult than it has been up to date, especially as it will probably be applied, at any rate so far as rhinoceros are concerned, to Backward Tracts which were outside the area to which the provisions of the old Game Laws applied.

(*b*) *Protected animals* may only be hunted under license. Without a license it is illegal knowingly to possess or sell or buy such animals alive or dead, or their parts or products. An important addition to the list of protected animals as compared with the previous Game Rules is *thamin,* the brow-antlered deer, the numbers of which have been very seriously depleted in recent years.

(*c*) *Animals protected by close seasons.* Hog-deer, sambhur and barking deer are protected from the 15th June to the 30th September and all game birds from the 15th March to the 30th September. The possession or sale of such during respective close seasons is prohibited.

An entirely new section prohibits the capture, possession, purchase or sale of live snipe, wild duck, teal and wild geese during the whole year. This is an important section designed to prevent the cruelty entailed by keeping these birds alive. No attempt has been made to protect in a similar manner partridges, quail and jungle fowl as cruelty can less well be substantiated.

Power to add any other animal by notification to the list of animals protected in any of the above categories has been vested in Government.

Section 10 prohibits hunting, by use of poison, pitfalls, machans, hides, pits, or artificial light for animals other than carnivora. It prohibits the shooting of animals other than carnivora from the back of an elephant or any kind of wheeled vehicle or aircraft, and the use of elephant or wheeled vehicle or aircraft to drive, stampede or disturb any animals other than carnivora. Hunting within 200 yards of an inhabited Buddhist monastery or religious edifice for which trustees have been appointed, the use of explosives for fishing in reserved forests and hunting with dogs except in the case of carnivora, hares and birds, are likewise forbidden.

Section 11 regulates the export and import of animals.

The term 'animal' includes all birds, mammals and reptiles other than snakes found in a wild state in Burma, and in reserved forests, fish. Outside reserved forests fish come under the provisions of the Burma Fisheries Act for which reason it was not possible to regulate fishing outside reserved forests under the Wild Life Protection Act.

The Act provides for penalties and gives powers to Forest Officers and Game Wardens to compound offences. Various other powers are given to Police Officers, Forest Officers and Game Wardens under the Act. Exemption is granted to the trustees of the Victoria Memorial Park, Rangoon (Zoological Gardens) for the acquisition, possession, sale, exchange, import and export of any animals. The keeping in captivity of animals and birds other than completely protected or protected animals for purposes of

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display, educational purposes or in public parks and gardens is permitted.

The above précis of the Burma Wild Life Protection Act of 1936 may be of interest outside Burma. It has been generally approved in Burma and met very little opposition. The one drawback, to the Act, is that it permits possession and sale of rhinoceros blood in certain circumstances, but the fact that such a comprehensive Act has been passed through a modern Legislative Council is a considerable achievement and a noteworthy example of the attitude of the general public in Burma and more especially of the politicians, to wild life protection.

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AN APPEAL

Wanted Stag Beetles.

I am engaged in preparing a volume upon the Stag-beetles (Lucanidae) for the Fauna of British India series and should be very glad to get into communication with any collectors who might be able to assist. The large males of several Indian species are well known, but there are numerous other kinds which are very inadequately known and females are difficult to identify. I shall be happy to name and return, if desired, any specimens sent to me. Very careful packing is necessary when sending specimens by post.

GILBERT J. ARROW,
Author of several volumes
in the Fauna of British India Series.

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MISCELLANEOUS NOTES.

I.—ASSOCIATION BETWEEN A LEOPARD AND A TIGRESS.

While tigers and leopards may sometimes be turned out of a somewhat small patch of cover, no such association as that instanced in Iftikhar Ali Khan's interesting note has been previously recorded. There seems to be no sufficient reason why there should not be hybrids between tiger and leopard. Mr. F. C. Hicks, in his book *Forty Years Among the Wild Animals of India*, states that he shot 'an undoubted hybrid between a tiger and a panther,' described as follows:—'Its head and neck were purely those of a panther, but with a body, shoulders, and neck-ruff unmistakably of a tiger, the black stripes being broad and long, though somewhat blurred and breaking off here and there into blurred rosettes, the stripes of the tiger being most predominant on the body.' The animal was an old male, measuring a little over eight feet in length. Unfortunately this unique specimen disappeared in the confusion and illness caused by Mr. Hicks being mauled by a wild beast.

In *The Field* of 18th January, 1908, the skin of an abnormally-marked leopard, which may have been such a hybrid, is thus described:—'Although the markings present some approximation to the jaguar type, the head and back are ornamented by an altogether peculiar kind of meshed network of broad buff lines, the first mesh which occupies the head being much larger than all the others.' The markings are stated to bear no approximation to the tiger type, and it is remarked that tigers are seldom found in the district of the Deccan from which this animal came. But tigers have lines, and meshed markings on the head. In hybrids I believe the more primitive type is biologically predominant, so a hybrid tiger-leopard would perhaps be more approximate to the leopard. The fact that tigers are seldom found in the district favours the hybrid theory, for the two species would be more likely to mate where one is seldom found, and where it could find no mate of its own species.

CHARLTON KINGS,
GLOS. ENGLAND.
January 29, 1936.

R. G. BURTON,
Brigadier-General.

II.—TWO WARY TIGERS AND TWO OTHERS.

Receiving news of a kill late one afternoon I hastily had a machan put up over the victim, a well-conditioned cow. The tiger had made a good meal and the cow's head had been chewed off. Although the ground was too hard for tracks to be seen there was every indication that the kill was that of a tiger. When at

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about 7 p.m. a panther rolled up I thought that the kill was possibly the work of two panthers and laid the feline out. Four cases have occurred in this district of two panthers at a time being bagged on a kill, and I now waited for its mate to turn up. Sure enough I soon heard an animal approaching but on its arrival near my tree I was convinced by the heavy tread that it was a tiger. The tiger, as it turned out to be, made the usual detour around and then approached the kill on the side the panther was lying dead. It was now almost dark, but I could tell exactly what was happening: the tiger stopped, evidently spotting the intruder, hesitated but for a moment, then landed on the panther with a mighty leap, and as the latter showed no signs of life started to drag; and here I made my mistake. I should have allowed the tiger to make a meal of the panther, if that was its intention, and then to return to its original kill. The tiger dragged the panther through long grass and for a moment I distinctly saw a whitish patch appear, which I took to be the tiger's chest, and fired. The tiger bounded away with a roar and did not return again to the kill. On the following morning I found traces of blood and spent three days tracking the tiger with no result.

A fortnight later another kill occurred and on arriving at the spot the first thing I noticed was the head of the kill lying to one side, and all around tracks of a big tiger. My Shikari, strictly against orders, had moved the kill slightly to present a better target to the machan. The tiger turned up at about 7 p.m. and, evidently realising the kill had been moved, for one hour stood suspiciously to one side and then slowly walked away and never returned.

A week later another kill occurred, here again the head had been severed and the tracks of obviously the same tiger were close by. The kill was in very thick cover and it was necessary to cut away a few branches to enable the kill to be seen from the machan. This too made the tiger, which arrived on the scene just after dark, suspicious, and it abandoned the kill as before. These three kills were on the hills.

Subsequently frequent kills occurred on the plateau off the hills and in every case the head of the kill was bitten off, earning for the tiger by now the sobriquet 'head biter'. Never would the tiger return to its kill the second night, and the killing went on freely for nearly two years. I once thought I had him: I was sitting up over a kill with its head *half* chewed off. The weather was wretched and at midnight deciding the tiger would, as usual, not return I lay down on the machan. At 5 o'clock in the morning I was awakened by a slight noise on the kill and rose to a sitting position very slowly. I could hear something eating very quietly, and very unlike the noise made by a tiger on its kill. It was a tiger however, an enormous brute, and made the welkin ring with his roars on receiving my shot. To my surprise I found he was tailless. He was duly carried to the road three miles away, tied to the luggage rack of my car, and the huge tailless creature caused great excitement amongst my employees. If he had possessed a tail he would have measured quite 10 ft.

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Soon after this other kills occurred down below with their heads severed and I realised that the head-biter had not been brought to book after all.

Three months later two cows were killed near my cattle kraals and there was every indication that the victims were those of the head-biter. The manager of the next Estate and I sat up with the same fruitless result. On the following afternoon I received news that a buffalo had been killed out in the open on a hill above the cattle sheds and reached the spot in quick time; I was pleased to see that the tiger had neither eaten nor dragged the kill; here was a chance anyhow. I lay down on a rock not far from the kill with a roll of bedding in front of me as I was determined to spend the night there if necessary. At 6 p.m. just as the light was getting poor the tiger walked out of a large shola and strode rapidly across the open maidan; I fired as it reached its prey. The tiger leapt into the air with a roar and crashed out of sight into long grass and then into a small shola where I heard it struggling, followed by silence. As it was dark very soon after this, nothing further could be done. We found it dead next morning, and no heads have been bitten off tiger kills since! It measured 9½ ft.

A month later a large tiger started killing on the hills, and by not returning to his kills on the second night he showed himself to be not less wary than the head-biter. Fruitless nights were spent on machans and I felt there was not much chance of bagging the animal, over a kill at any rate.

News came in early one morning that a cow that had strayed from its pen had been killed. As the kill had evidently occurred just before daylight, and the tiger had eaten very little, this seemed more promising. I was in the machan at 4 p.m. and at 6 o'clock I heard the tiger nearby. He was the embodiment of caution and having taken one hour to make up his mind to approach the kill and then did so very slowly and cautiously. Instead of feeding, the tiger lay down a yard or two to one side in thick *Strobilanthes*, and for nearly another hour complete silence reigned while he listened intently for the slightest unusual sound. Partially satisfied he then got up, walked round the kill through the *Strobilanthes* two or three times growling softly, and finally commenced to feed. Immediately my torch shone on the kill the tiger was away in a bound, and this was repeated half an hour later when he made another attempt to feed. The tiger then went away giving tongue angrily and I did not expect to see him again. However at 5·30 in the morning the tiger returned probably very hungry. The tactics he now adopted were to rush the kill, seize a mouthful, and jump to one side into the *Strobilanthes* where he could eat in safety. This exasperating state of affairs continued till 6 a.m. when it was still dark inside the dense evergreen shola. It was a problem whether to await the coming of daylight or to take the risk of using the torch as the tiger approached the kill for one of his snatch and grabs, and I decided on the latter course as it was uncertain that he would carry on the game until there was light enough to shoot. Awaiting my chance I switched

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the torch on the tiger as he was just about to tear a large hunk of meat from the kill and fired, badly wounding him; but before I could fire my second barrel he got away crashing up against my tree in his rush. A few moments later I heard the tiger gasping in the jungle to my right and then silence.

When it was quite light I called up my men and very quietly followed the tracks (there was very little blood) through the *Strobilanthes* which showed clearly the tiger's line of retreat. The *Strobilanthes* got thicker as we went slowly forward until we eventually came to a rock where, sensing that we were close to the tiger, I put my men up trees. I was sure I had heard something though what it was I could not tell. After ten minutes of intense silence we distinctly heard him breathing heavily in a hollow to our front. The tiger located, I could now form a plan of action: returning on our tracks with my men I sent for a herd of cattle from a nearby pen. The Sholagas were instructed to drive the cattle to the edge of the hollow where the tiger lay, below where we had stopped, to suddenly give vent to almighty yells and shouts to stampede the cattle into the hollow and to shin up trees immediately. I was to cut off the tiger's retreat (outside the shola) in the open grassland, beyond where he was lying up. The plan worked well: I heard the cattle being driven into the shola, then a frightful uproar, and the cattle crashed down into the hollow snorting and bellowing as they scented the tiger or rather where he had been. From where I was sitting on a rock the ground sloped gently down towards the shola, and then steeply to the shola's edge. Suddenly I heard langurs, sitting on trees in the jungle behind me, giving vent to the particular call they reserve for felines, and looking round the thought struck me that I was too late, that the tiger had crossed over the grass maidan into the jungle beyond before my arrival. I did not realise that the langurs perched on tree tops, could see the tiger walk out of the shola I was covering, before coming into my view, until a growl brought me round again in quick time to find that he had advanced to within a few yards of me: I slew him in the nick of time, a large brute, 9 ft. 6 in. My first shot had wounded the tiger in the stomach, and he would have been a nasty customer to deal with had I not killed him when I did.

In September last year my brother-in-law wounded a tiger over a kill he and I were sitting over. The machan was placed at an awkward angle, and it was a long shot. Early on the following morning we were on the tracks and soon realised that we were to deal with a tiger with a smashed foreleg. The tracks led out of a deep ravine, in which the kill had occurred, up on to a stony flat sparsely dotted with patches of thick scrub, and here it was most difficult to pick up the tracks with any certainty as the ground was dry and hard. Eventually an excellent tracker we had with us, discovered that the tiger had passed through a small patch of scrub in which he had lain down, and from here on the tiger appeared to have rested in nearly every bit of cover in his path. In the meantime a herd of cattle that had been sent for arrived on the scene and the tracking continued with the

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herd spread out ahead. The cattle had just reached a largish area of dense cover lying in a hollow when they were stampeded in all directions by a terrific roar. Here the trailing of a wounded feline with the aid of cattle was put to good purpose: the tiger was located, and it was no longer a case of odds on the tiger if he charged. Advancing cautiously we found he had moved out of the cover and over a rise into another hollow where he was undoubtedly lying up. Having placed ourselves in suitable positions our trackers threw a stone into the cover, this was greeted with a long-drawn snarl; and at the next stone the tiger charged giving vent to a series of coughing roars. Although handicapped with a broken foreleg and the rising ground he came at a great pace and was within a yard or two of us as he broke cover. Receiving our simultaneous shots he rolled over but was up at once and made a gallant attempt to get at us again; but our second barrels did their work and the tiger crashed headlong down the slope and lay dead, a fine massive brute, 9 ft. in length.

HONNAMETTI,
ATTIKAN P.O., *via* MYSORE.
November 28, 1936.

R. C. MORRIS.

III.—STRANGE BEHAVIOUR OF A TIGRESS.

The following account of a 'leopard' on a neighbouring tea garden may interest your readers. The animal first appeared about Christmas time, and for two months stayed in the vicinity, killing at least five calves and one pig, all in houses. On one occasion after killing a calf in a house and taking it out, the marauder was chased away, but returned at 2 a.m. and was fired at and missed. Yet it returned again to take away the kill before daylight.

During a space of ten days this animal appeared four nights in the manager's bungalow compound, and endeavoured to break into the hen-house. Once it appeared at the steps of the back verandah. One night while in the compound two shots were fired at it, both missed.

Reports of those who had seen the animal agreed that it was a leopard with a tiger's face. Thereupon my friend devised a portable all-iron goat trap to catch this extraordinary creature Almost immediately the animal was caught on March 9th and turned out to be a tigress, 8 ft. 3 in., nearly dry of milk. Cubs were supposed to have been heard of in the district.

She was in an emaciated condition, and covered with ticks, some the size of a 3-penny piece. Is it not unusual for a tigress, even though starving and with cubs, to take to the habits of a house-invading leopard? Presuming she had not the strength to kill a buffalo or large bullock, there were thousands of cows and calves throughout the whole district on the fringes of the jungle—an easy prey to the cattle-lifting tiger.

BADLIPAR P.O., ASSAM.
April 11, 1937.

E. P. GEE.

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IV.—MEASUREMENTS OF TIGERS IN THE NAGA HILLS, ASSAM.

Since 1927, I have kept a careful record of the lengths between pegs of tigers shot on this and on eleven other neighbouring Estates. Total 59—Tigers 27, Tigresses 32. The average length of 18 full grown males is 8 ft., 7 in., and of 25 females 7 ft. 9 in., only one tiger exceeded 9 ft., this taped 9 ft. 6 in., and was quite exceptional.

I have only three accurately recorded weights. Two large males weighed 330 and 344 lbs. respectively, and a small tigress 218 lbs. It would appear that the tigers of this particular district, are definitely smaller animals than those recorded from other parts of India. I would add that the majority are game killers inhabiting the dense evergreen jungles at the foot of the Naga Hills, which tends to support the views of the old Shikaris, that the game killer is a smaller more active beast.

TOWKOK TEA ESTATE,
SONARI P.O., G. H. L. MARSHALL.
SIBSAGOR, ASSAM.

March 18, 1937.

[Mr. Marshall's measurements of Tigers shot in the vicinity of Naga Hills are of much interest and suggest the need of similar data from different parts of India. We have Sir John Hewett's record of Tigers shot by him (Rowland Wards' Records, 1928 edn.) in Garhwal and Naini Tal. Eight males ranged between 10 ft. ½ in. to 10 ft. 5½ in. While 7 females were between 9 ft. to 9 ft. 3 in. Compared with the measurements given by Mr. Marshall it would appear that tigers in Garhwal are much larger than those from the Naga Hills. Unfortunately Sir John's records from Naini Tal and Garhwal all relate to large animals and we do not know whether any smaller animals were shot by him in this area and have therefore no means of arriving at conclusion regarding the average size of tigers in Garhwal. It is generally assumed that tigers from South India are on the average smaller than those from Central and Northern India. Average measurements arrived at from records such as Mr. Marshall has kept, if obtained from different provinces, will alone help us to arrive at definite conclusions regarding the size attained by tigers in different parts of the country.—EDS.].

V.—MANGE ON WILD DOGS.

I recently shot two wild dogs, a male and a bitch, which were as badly affected with mange as I have seen on any pie dog. The dogs were feeding ravenously on a three-days-old tiger kill, and seemed to be quite active.

With the exception of the head, which was blotchy, and the ridge of the back the dogs were almost devoid of hair including

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the tail. The short pig-like tail, free of the brush or hair, and the pink and mangy fleshy appearance of the flanks and stomach gave the dogs quite a revolting appearance.

HONNAMETTI ESTATE,
ATTIKAN P.O., *Via* MYSORE, R. C. MORRIS.
February 6, 1937.

VI.—NOTES ON HARDWICKE'S HEDGEHOG (*HEMIECHINUS COLLARIS* GRAY & HARDW.).

During a visit to the Great Rann of Kutch, in October 1935, I collected about ten living specimens of *Hemiechinus collaris* at Kawra, Pachum Island. This hedgehog is quite plentiful around the village.

Most of the specimens, I discovered later, were pregnant females. From Kawra to Bhuj, a distance of some fifty miles over roughish tracks, the hedgehogs travelled in a sac on the floor of the car. On arrival at Bhuj they were transferred to a packing case pending my departure for Bombay. To my surprise, the next morning after our arrival at Bhuj, I discovered that the females had discharged their respective fœtuses. No two of the fœtuses appeared to be of the same term. The only reason I could discover for these wholesale abortions was probably the car drive!

An interesting point emerges from this incident. According to Dobson (*vide F.B.I.*, Mammalia, p. 214) the number of young at a birth never exceeds four. But what is the 'normal' number? From the premature births referred to above and the disparity of age observed in the fœtuses, it would appear that only one at a birth is the 'normal'! If there were more than one, surely there would have been some fœtuses of the same age, and again the number of fœtuses would have exceeded the number of hedgehogs in the box! This was not the case.

Hedgehogs appear to be most numerous in the neighbourhood of villages. The reason for this probably being the nature of their diet. They live on almost any refuse. Small mammals, birds, batrachians and reptiles also form part of the menu. In captivity they drink milk readily. These animals soon become quite tame even when caught old. They fight much when several are kept in the same cage. The usual point of attack is the legs and sometimes the face. A hedgehog will catch the leg of an opponent and immediately curl up and the leg is usually bitten off—the antagonist is killed eventually piecemeal. Under stress of excitement or pain the call is very kitten-like.

BOMBAY NATURAL HISTORY SOCIETY,
BOMBAY. C. McCANN.
October 24, 1936.

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VII.—SOLITARY BULL BISON (*BIBOS GAURUS* H. Sm.).

I have more than once expressed the opinion that old solitary bull bisons have not necessarily been turned out of the head by younger bulls, a widely-held belief. This has also received support in connection with the African buffalo. My theory is that in the majority of cases the bull arrives at an age when he leaves the herd of his own accord; and in his solitary life he develops in strength. When he wishes to rejoin a herd temporarily during the breeding season he does so, and has no difficulty whatsoever in becoming the master of the herd for 12-14 hours, before retiring from the proximity of the herd daily. In other words he joins the herd at about 5 or 6 p.m., remains till 7 or 8 a.m. in the morning, and then walks away to a secluded place.

A case in point: a herd of 40 bisons near here; a fine old solitary, with horns worn down to about half their original length, an immense bull, takes possession of the herd daily in the manner indicated during main breeding season. The other herd bulls fight with each other, but leave the old fellow severely alone; he is obviously more powerful than they are. The breeding season over, the solitary leaves the herd for another nine or ten months.

Honnametti Estate,
Attikan P.O., *Via* Mysore. R. C. MORRIS.
January 6, 1937.

VIII.—WHISTLING SOUND MADE BY BISON (*BIBOS GAURUS* H. Sm.).

On page 151 of his book, *Wild Animals in Central India*, Dunbar Brander refers to the whistling of bisons as one of the most peculiar sounds made by them and associates it with breeding.

While shooting in the Cochin State Forests in the early part of December 1935 this whistling was heard by me on two different occasions. On hearing it the first time I thought it was made by some big bird and the tracker on being asked said it was made by a bull bison.

Immediately following on the whistling sound, bellowing and crashing in the undergrowth were heard and on going in the direction of the sound, we realised that two bisons were fighting. The wind being unfavourable the fight was interrupted, one bull being seen as he turned round to look at us, while the rest could be heard crashing away into the jungle.

The second occasion on which whistling was heard was at about seven in the morning, the sound being repeated two or three times. I was unable to come up with this herd.

I feel sure that this whistling sound has to do with the breeding season as most of the bull bison have joined the herds by November

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in these forests. I saw a bison bull jump a cow early in November 1934 in the same locality.

TANJORE, C. H. BIDDULPH.
February 9, 1937.

IX.—COLOURATION OF THE BISON'S SNOUT AND TONGUE.

With reference to Mr. C. H. Biddulph's note, in *Journal*, vol. xxxix, p. 165, on variation in colouration of the exposed part of two bull bisons' snout and tongue: it is not at all uncommon to see the snout of mature bulls pinkish in colour: though rarely so in the case of cows. One bull, a solitary, I recollect seeing some years ago, had a snout that was almost red! The colour of the tongue varies from white, greyish-white, to grey.

HONNAMETTI ESTATE,
ATTIKAN P.O., *Via* MYSORE. R. C. MORRIS.
S. India
February 4, 1937.

X.—REPLACEMENT OF HORNS IN NILGAI.

I was very interested indeed in Mr. Hall's notes on 'The Growth of Horns in Nilghai'.

So far I have shot well over a hundred of these ungainly antelopes. As far as my observations go they are as follows.

I don't think the Nilghai sheds its horns in such a way as deer do, nor do I think the horn is shed revealing new ones of small size at the base. At least they do not do it on our side of the world. In all I have seen six or seven Nilghai shed their horns. All these had average size horns. But it was the outer covering that was peeling off the horn and the inside horn was of the same length as the one that was chipping off in pieces. Sometimes the outer covering takes quite a time to come off. First the outer horn cracks along the length of the horn and then due to friction made by the Nilghai rubbing its head against a tree the horn starts falling in small bits revealing a beautiful shining black horn inside.

So far I have not seen such shedding of horns in small males. It is always the big full-grown bull that sheds. In my opinion they must be shedding at very long intervals.

Any way I should very much like to know more about it.

RANJIT VILAS PALACE,
WANKANER, CHANDRABHANUSINHJI
April 5, 1937.

[As indicated in the Editor's comment to Mr. Hall's note (*J.B.N.H.S.*, vol. xxxix, No. 1, p. 172), horn replacement, when it takes place among Bovines is not effected by the shedding of the horns, but by a process of exfoliation, the older horn pealing

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off gradually till the fully developed new horn underneath is bared. The above note confirms the view that such horn replacement takes place in the Nilgai. An interesting point is that the replacement in nilgai is effected not during adolescence but in maturity.—EDS.].

XI.—AN ELEPHANT 170 YEARS OLD.

(*From The Times, London*).

In connexion with the longevity of animals, concerning which some correspondence appeared in *The Times* a few weeks ago, my attention has been drawn by Dr. P. E. Pieris, Trade Commissioner for Ceylon, to a record of a remarkably long-lived Asiatic elephant. In a translation of Joao Ribeiro's 'Ceilao' by Dr. Pieris (third edition, 1925) mention is made of a famous elephant, Ortela by name, which was probably a fully adult animal prior to the siege of Colombo in 1656, since we are told that the animal at this time had 'offspring and descendants.' The same specimen is referred to by Emerson Tennent in his 'Natural History of Ceylon' (1861) as still being alive when the British flag was hoisted in Colombo in 1796. This elephant is reported by Tennent to have been found in the stables by the Dutch on the expulsion of the Portuguese in 1656 and served under them during the entire period of their occupation, more than 140 years. During the siege of Colombo, Ortela was the only elephant out of 15 animals which was not eaten by the defenders, and it is said that it did much useful work in bringing up trees to repair the breaches in the city walls.

From the evidence available it would appear that an elephant's age is determined by its teeth, and that as soon as the last molar tooth is in position on each side of the jaws a period is set to the animal's existence. Elephants' grinders succeed each other by horizontal, not vertical succession, moving forward in the arc of a circle and pushing the old teeth out in front. There are six cheek teeth developed on each side of both jaws, three being the so-called 'milk molars' and three the permanent molars. Not more than one, or parts of two or sometimes three teeth, are in wear at one and the same time, the elephant being very economical regarding the use of its teeth. Each successive tooth with the exception of the fourth, or first permanent molar, is more complex than its predecessor, the number of ridges increasing according to the following formula: 4, 8, 12, 12, 16, 25; this formula applies only to the Asiatic elephant, the African beast having its teeth arranged on a more simple plan, the ridges not being so numerous (3, 6, 7, 7, 8, 10-12). Doubtless when the animal's diet is free of grit or sand the teeth will last longer than when these impurities are present, but under the most advantageous circumstances an elephant living for 170 years or so is a fact which is very astonishing.

BRITISH MUSEUM (NATURAL HISTORY),
CROMWELL ROAD. GUY DOLLMAN.
April 21, 1937.

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XII.—WHALE-BONE WHALE STRANDED ON THE TRAVANCORE COAST.

A whale was stranded on the sea-side at Pulluvila about 12 miles south of Trivandrum on the morning of 4th February 1937. The animal had been dead a few days; for when I inspected it on the following day the flesh was in an advanced state of disintegration, and some of the bones, blubber and the guts were exposed. It measured 45 ft. in length and the girth at the fore limbs (fins) has been estimated at 10 ft. Other measurements evidently could not be obtained. The baleen plates had decayed and the jaw bones were exposed. From what could be seen of the specimen, I am of opinion that it belongs to the Balænoptera sp. probably *Balænoptera indica*. While preparing the skeleton for acquisition to the local Museum a few bones of the left fin have been found to be shattered.

Instances of whales set ashore by the sea have been rare on the Travancore coast. In February 1902 a False Killer (*Pseudorca crassidens*) was stranded at Trivandrum and a big Baleen Whale was reported to be found at Rajakkamangalam also on the South Travancore Coast in about January 1904. None else have recently been recorded. It is noteworthy that in all these instances the time has been between January and March.

GOVERNMENT MUSEUM,
TRIVANDRUM, TRAVANCORE STATE. R. V. PODUVAL,
February 15, 1937. *Officer-in-Charge.*

XIII.—UNCLEAN ANIMALS.

Hares once given the opportunity, without doubt are filthy feeders. The ordinary jungle animal living remote from villages is quite fit for human consumption. The same applies to the wild pig: there is little that is offensive in his diet and flesh and I have often eaten him.

But when human excreta is readily available it is their 'habit' to eat it; just as rabbits make a 'habit' of dealing with corpses when similarly placed.

During the famines in the Central Provinces, a temporary population of some 5 to 10,000 persons would be collected on a construction camp—say the bund of a tank. This population lived in the adjoining fields. Hares in numbers used to collect round these camps and apart from often having seen them eating excreta, their breath testified in an 'overwhelming' manner to their habits.

It may be of interest to mention that the ancient Jews recognised the uncleanly habits of hares in laying down the law as to what shall be 'clean' and 'unclean' flesh. They tried to base this on certain general laws of nature, which would have general application. In attempting to do this they got wrong in their Natural History, although they were sound in their hygiene, which was the

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purport of the prohibitions. 'And the Hare, because he cheweth the cud, but divideth not the hoof—he is unclean to you' (Lev. xi. 6).

It is believed that Mohammadans generally follow the same law, also Armenians and Laplanders: and it was forbidden food to ancient Britons on religious grounds: a very common device of enforcing a law which might otherwise be ineffective.

I have never known the Painted Partridge behave in any way which would make him suspect: I can hardly say the same of the Black Partridge, but my experience of him is not sufficient to have any weight. The Grey Partridge on the other hand used to collect round famine camps, and can often be seen round villages busy with excreta, and his breath is often unspeakable.

Both varieties of Jungle fowl are also suspect, sometimes quite definitely 'guilty': but not nearly so to the same extent as the grey partridge.

While on this subject I would warn your readers to vet any peacock they propose to eat. I have often turned out a lump of pure human excreta as big as a tennis ball, out of a peacock's crop: it is advisable, if near a village, invariably to smell the breath.

IVYBANK,
BISHOPMILL, ELGIN N.B.,
SCOTLAND. A. A. DUNBAR-BRANDER.

January 12, 1937.

XIV.—CLOSE SEASONS FOR BIG GAME—ARE THEY BENEFICIAL?

It may be taken that a close season in respect of game animals and birds is imposed in order to ensure their being undisturbed during either the breeding season or when the young are being born.

There is no doubt that in the case of birds a close season is very necessary; but under present conditions it is becoming increasingly apparent that in India, except for a few areas very strictly protected, wholesale poaching of game of both sexes is such a serious menace that a close season now defeats its own object by allowing the poacher unhindered scope for his pernicious activities.

Further, in an examination of the close season (15th June to 15th October) as applying to South India it is found that the imposition of a close season to cover big game in general is of little value.

Sambhur:

Breeding season *mainly* November-December—Open season.
Young born, August-September (also June-July)—Close season.

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Chital:

Breeding season *chiefly*, April-May—Open season (though breeding occurs, and young born, throughout the year, according to age).
Young born *chiefly*, November-December—Open season.

Muntjac (Jungle Sheep):

Breeding season: October-November—Open season.
Young born, April-May—Open season.

Chausinga (Four-horned Antelope):

Breeding season July-August—Close season.
Young born, January-February—Open season.

Bison:

Breeding season *mainly*, November-March—Open season (July-August to a lesser extent).
Young born *mainly*, August-December—Partly Open season (April-May also to a lesser extent).

Tiger:

Breeding season *chiefly*, April-May (also October-November)—Open season.
Young born *chiefly*, February-March (also August-September): Open season.

Panther:

Breeding season *mainly*, December-January (also May-June): Open season.
Young born mainly March-April (also September): Open season.

Bear:

Breeding season *chiefly*, April-May—Open season.
Young born *chiefly*, December-January—Open season (also August to a lesser extent).

Blackbuck:

Breeding season *chiefly*, April-May—Open season.
Young born, September-October—Close season.

Where lies, in the majority of cases, the protection a close season is supposed to afford? Under the circumstances, and in view of the fact that during the close season a very large number of animals are slaughtered by poachers who cannot then be disturbed by sportsmen in the jungles, I consider that a general close season in respect of big game should be abolished in South India.

HONNAMETTI ESTATE,
ATTIKAN P.O., *Via* MYSORE.
October 31, 1936.

R. C. MORRIS.

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XV.—OCCURRENCE OF THE RUFOUS SHORT-TOED LARK (*CALANDRELLA BRACHYDACTYLA DUKHUNENSIS* SYKES) IN NORTHERN BURMA.

The Fauna (2nd Edition) states that this Lark 'occurs in Burma', but apart from one specimen obtained by Dates near Pegu on April 25, 1880, no one seems to have observed or obtained it, and it has not yet been recorded from Yunnan. On April 6, 1936, I shot a single bird out of a flock of 20 or 30, which was feeding on a bare patch of stubble close to Myitkyina. The flock remained circling over the plain for the next half hour but when they eventually alighted, I was unable to find them again owing to the presence of a Peregrine Falcon. The weather at the time was unusual, very cold with occasional heavy rain-storms and possibly these birds were driven down from the higher hills. La Touche however noticed this species on passage in Eastern China between April 11th and 19th; I am quite certain that these are the first Short-toed Larks I have ever come across in Burma.

I am indebted to Mr. N. B. Kinnear for identifying this specimen which is now in the British Museum, with the other Burma specimen.

LONDON. J. K. STANFORD, I.C.S.

January 16, 1937.

XVI.—THE EGG-LAYING OF THE KHASIA HILLS CUCKOO (*CUCULUS CANORUS BAKERI* HARTERT).

We record an extract from an article by Mr. T. R. Livesey contributed to the *Times of India Annual*, 1937 in which the author gives his personal observation of a cuckoo depositing her egg in an inaccessible nest at Taunggyi, S. Shan States, Burma, on the 24th April 1936. The cuckoo concerned is the Eastern Cuckoo (*C. canorus bakeri*) and the selected fosterer was the Burmese Stone Chat (*Saxicola caprata burmanica*). The article in an amended form is reproduced by courtesy of Mr. Francis Lowe, Editor of the *Times of India*.

Mr. Livesey describes the incident as follows:—

'On April 22, at about 4 p.m., a cuckoo came flying slowly to the corner of the stubble field, some 60 yards from my cottage. It settled on the ground within 20 yards of me and began looking about. A pair of Stone Chats were in attendance and in much alarm. The cuckoo flew off, but shortly after returned and pitched in the field at about the same place. To watch it better I went in and got my field-glasses. The cuckoo had its mouth open and its throat feathers puffed out, and was panting like a domestic fowl on a hot day. The reddish marking on the neck showed it to be a hen bird. She began to move about as if searching for something, so I suspected a chat's nest there. After she had flown away I went and looked. Sure enough there was the chat's nest four yards from the fence. It was somewhat conspicuous, as the

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hole under a clod of earth in which it was wedged was the only hole in that vicinity. I could see it from some distance.

'The nest was of the usual type so common in the Shan States, wedged in a cavity under a clod of earth. The edge of the nest was visible, but one could not insert one's hand to touch the eggs, as the top of the clod overhung it. The entrance to the nest was about two and a half inches long, by about one and a half inches in height. By stooping down I could just see the three eggs it contained. They appeared to be fresh, and as the cuckoo had not laid, I thought there might be a chance of her returning to do so. I therefore had a 'hide' quickly erected on the other side of the fence. In it I was completely invisible, with a clear and uninterrupted view of the chat's nest five yards in front of me, and with its entrance hole facing me.

'I had not been in my hide more than a few minutes when the cuckoo flew back over the field. A few minutes later she flew towards me, but turned off out of sight again. For the next half hour nothing of note happened, and then suddenly I saw her flying straight at the nest. This time she pitched about three paces beyond the nest. She then began to move about in the stubble among the clods of earth, every now and again mounting a clod to see better. She was searching diligently for the nest! On she came till she was within three feet of the nest, and I thought that the Cuckoo's Secret was mine! Through my glasses set at +5 I could see every feather on her, and the edge of the chat's nest was as clearly seen as if it was but at arm's length away. But the cup was dashed from my lips!

'She appeared to fail to find the nest. The entrance hole was facing my way. Did she, or did she not know exactly where the nest was? This is a very interesting point. To my disappointment she passed off at a tangent down the field and out of sight. Fortunately she had not seen me. I waited till it was too dark to see but she did not return. Next day, April 23, I hung about from three o'clock in the afternoon till five, when not seeing anything of the cuckoo, I went off for a walk. The chat's nest now contained four eggs. I did not enter the "hide" at all but left my deck chair in it in case I should need to wait next day.

'Next day, April 24, the chat's nest had five eggs in it. I kept a good lookout for the cuckoo most of the day. It was cloudy and hot, and sounds of distant thunder came from the north. I had almost given up hopes of seeing the cuckoo when I suddenly saw her sail up into the one big tree by the house. It was about 5 p.m. but of course full daylight. I got my glasses on to her. She seemed to be the same hen bird. I left her sitting in the tree and hastened into my "hide". The chats were close to me and not suspicious. The cock chat broke into his short song and the hen fluttered down and entered her nest. I sat back in the chair and adjusted the glasses to +5, which gave perfect definition of the nest at five yards' distance. It looked as if I could put my hand on it!

'Suddenly the cock chat sounded his alarm note and on the instant the hen flew off the nest and up on to the fence over my

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head. Both chats became much alarmed and I suspected the presence of the cuckoo. Then down swooped the cuckoo with both chats in hot pursuit, but she passed beyond the nest and carried on out of sight. A few minutes later on she flew past again, but this time over the nest—again pursued by the angry chats. These were moments of tense excitement for all of us! Then she came again, and this time she pitched as she had done before, some three yards beyond the nest. Again she climbed up on the clods of earth searching in all directions for the nest. Both chats were wildly excited, and kept stooping at her in attempts to buffet her, which she resented by opening her beak and making faces at them—at the same time raising her crown feathers. A few drops of rain began to fall. The sun was obscured by cloud. This time she seemed to know where the nest was, for she came on direct to it.

'Just as Cuckoo's Secret was about to be revealed to me and my heart was thumping with excitement—of course—the Gurkha mali came up to put a mat on the hide—to put the lid on it! I drove him away.

'The cuckoo was still there! Hotly mobbed by both chats, she waddled up to the nest and thrust her head into it and as she did so, her tail, which was closed, was tilted up in the air. Her head was in the nest for but two, or three seconds, and then she withdrew her head and her body passed from a horizontal to an upright and vertical position as she spread out her wings on either side of her and depressed her tail, wide-spread now, in the act of laying her egg. As she laid a spasm shook her body with a quiver and this was distinctly noticeable in the region of the rump, and lower back down to the root of the tail. My impression was of a butterfly quivering with a pin stuck through it. It was without possible doubt the very act of laying. It only lasted about three seconds. While she was laying her head was concealed from me but she appeared from her attitude to be looking down watching herself lay. At that moment the infuriated hen chat landed high on the cuckoo's back between her shoulders and clung savagely on with spread wings to the parasite! The cuckoo held her position only for about three seconds, as I have said, and then she jumped backwards with a sudden movement, throwing off the chat, and flew off. Her egg was left in full view about three inches outside the chat's nest! She had tried her best but had failed to get it in the nest! She had not been hurried, disturbed or frightened in any way. The cuckoo had gone.

'I got out of the "hide" and went to examine the nest and the cuckoo's egg lying outside it. Her egg was warm and quite dry with a lovely matt bloom to it, undoubtedly straight from the oviduct. It was of the usual yellowish-pink marked type that appears to have been evolved to resemble the eggs of the stone chat. It was marked with a cap of markings but at the "wrong" —pointed—end of the egg. Her egg was on the small side, and it is possible that she was in her first season and not yet experienced in depositing her eggs.

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'There were now only four chat's eggs in the nest, so the cuckoo must have removed one of the chat's eggs, but her movements had been so quick that I had not been able to see whether she had swallowed or flown off with it in her bill. My impression was that she had no egg in her bill when she flew off. The chat's nest had been slightly disturbed by the pressure she had exerted against the entrance in trying to lay her egg into it. Some particles of earth had fallen in on to the chat's eggs. It was at once a great triumph actually to have seen the cuckoo lay before me like this, but at the same time somewhat of a disappointment, as her eggs had fallen outside the nest—a catastrophe that may occur perhaps only once in a hundred times. As the chat's nest was one that a cuckoo could not possibly get onto to sit upon, I half expected to see the cuckoo lay outside the nest and then pick up her egg and place it in the nest with her bill—a method she is suspected to use when such difficulties are present. What I saw however was the unexpected.

'I am inclined to think that I saw the cuckoo lay her egg in the usual way when confronted with an inaccessible nest. Another observation I made this year confirms it.

'But on the whole, I think it is unlikely that the cuckoo has more than one way of getting her eggs into an inaccessible nest, and that the way I have described will eventually be established as the cuckoos' normal and usual way of meeting the difficulty.'

TAUNGGYI, BURMA. T. R. LIVESEY.

February 28, 1937.

XVII.—CUCKOO INCIDENTS.

Those interested in the cuckoo will have read with the greatest interest the account of a cuckoo laying at an inaccessible nest as recorded by Mr. A. E. Jones and his wife near Simla.

I think that there was nothing abnormal in the behaviour of the cuckoo. What happened bears out my own observations. The cuckoo apparently decided to lay at an inaccessible Stone Chat's nest—and after the usual preliminary flight, or flights, to the vicinity of the nest as a preparation to laying—spread out its wings and tail, and tried to lay, or squirt, its egg into the Chat's nest: but owing to the inaccessibility of the nest the cuckoo only got its egg on to the edge of the nest.

The observation unfortunately was a chance one, and Mr. Jones does not make it clear exactly how far he was from the nest when the laying took place—nor does he say if he had field-glasses to observe it with.

The incident was very much the same as the one described by me as the second incident in my article 'The Cuckoo's Secret', published in the last *Times of India Annual* and recorded above, in which I saw, at about forty yards distance, a rough-and-tumble scrap between a cuckoo, two chats and a pipit at a pipit at a pipit's nest. In that case however the cuckoo got its egg safely

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into the pipit's nest, but it had not apparently sat on the nest to lay as is delicate dome was undamaged.

But observations by chance are not good enough to be of real value. We must, like Mr. Edgar Chance, sit up over the nest in a hide at a few feet distance from the nest and coolly await the coming of the cuckoo, with the aid of camera and glasses. Then there is a good chance of observing exactly what takes place.

From my experience the spread-eagle position of the cuckoo, with wings and tail expanded and the tail depressed, even crushed onto the ground—is *the laying position* at inaccessible nests and I have no doubt the cuckoo that Mr. Jones saw, assumed this position when she actually laid at the nest entrance though it may have escaped his observation at the time.

As to the possible regurgitation of the egg, I agree that such a feat was not performed in this particular instance. The regurgitation theory was killed by Mr. Edgar Chance's work as long ago as 1921, and I understand that that theory is not regarded seriously any longer. If anyone suspects that cuckoos regurgitate their eggs, they have only to shoot a cuckoo that is coming to lay and they can then see for themselves whether the egg is in the throat or in the oviduct. In this connection it may be mentioned that cuckoos are apparently in the habit of removing the fosterer's egg *first*—and laying afterwards. That would be an awkward preliminary to regurgitation!

Also the condition of the cuckoo's egg shows it to have come straight from the right end of the bird. Again in regurgitation there would be no need to depress and spread out the tail—*au contraire*—nor would the spasm of laying be observed in the lower back of the cuckoo and in the region of the cloaca.

In Mr. Jones' summing up Nos. 1, 2 and 3, are very true, I think, and interesting. It seems to me that the attitude of the intended dupes before being victimised may well be very different from their attitude when the act of parasitism is being actually carried out. In the preliminary association of the cuckoo and the intended fosterers, it may be that the cuckoo exerts some hypnotic influence over the latter. The curious 'stuck' look on the cuckoo's face as she sits side by side with the fosterers for some considerable time is most striking and strongly suggestive of hypnotism.

As to the attitude of the fosterer when it finds a cuckoo's egg just outside its nest that can be ascertained by setting up hides over various nests and playing tricks on them with Bulbul's eggs, or sparrow's eggs. I do not think that birds take the least notice of eggs *other than their own*—no matter where they are situated. I have found cuckoo's eggs lying outside chat's nests—quite close to the nest entrance, and apparently just as laid by the cuckoo. In these cases the chats did nothing to remove them apparently.

Birds can have no *inherited appreciation* of any other eggs but their own. Only in the case of the parasitic cuckoos do we find a bird that inherits an appreciation of another bird's eggs. In their case it is a necessity, I maintain, in the evolution of their parasitic habits.

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Finally it is noteworthy that cuckoos coming to lay are given to ruffling up their throat feathers—opening their mouths and panting. In other notes I suggested that the large and orange gape of the cuckoo operated as a warning when it is disturbed as a fledgling. This warning note may well continue into adult life to save it from the attention of hawks, etc., and be again employed in its combat with the intended fosterers when it comes to lay. That is my explanation of the cuckoo's habit of opening its mouth at the onslaught of the dupes.

It has been said that if a cuckoo were to squirt her egg into an inaccessible nest from a distance of several inches that her egg falling onto the fosterer's eggs would break them. I have just carried out two experiments in this connection. The first was to 'shoot' a cuckoo's egg into a nest of chat's eggs from a distance of four inches by propelling it between thumb and forefinger as a boy 'shoots' a marble. I had four chat's eggs in the nest. I found that when the cuckoo's egg landed fairly on a chat's egg that it broke it, that is to say, it broke *one* egg about three times out of four or five shots.

My next experiment was to find out whether the chats removed such cracked or broken eggs from their nests. I went round and broke a single egg in several chats' nests and then visited them again shortly afterwards. I found that such damaged eggs had been removed—got rid of. I think that these two experiments show how it is that we do not find the eggs of the fosterer damaged in any way by the cuckoo having squirted her egg in onto them from a distance. Her egg does in many cases break one of the fosterer's eggs, but that the fosterer very soon gets rid of the damaged egg.

TAUNGGYI, BURMA. T. R. LIVESEY.

February 28, 1937.

XVIII.—A NOTE ON THE DISTRIBUTION AND NIDIFICATION OF THE NORTHERN YELLOW-FRONTED PIED WOODPECKER [*LEIOPICUS MAHRATTENSIS BLANFORDI* (BLYTH)] IN SIND.

The Northern Yellow-fronted Pied Woodpecker is a permanent resident and not uncommon in Cutch, Kathiawar, North Gujerat and Mount Abu.

In Sind it is scarce and only locally common.

Blanford met with a pair at Umarkot on the Eastern border of the Nara Valley in the Thar Parkar district, and his collector obtained another from Kotri. Murray secured a single specimen from Sehwan, while Butler saw several skins from Hyderabad.

Scrope Doig believed that it bred in the Eastern Nara in April. Blanford as mentioned above, met with it at Umarkot, and when there in March 1936 myself, I was reliably informed that it was not uncommon further south, round about Nabisar, Char and Samaro.

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Hume surmised, from descriptions given him, that it occurred in the Khirthar. Ticehurst however remarks that he is certain this is not the case. I might mention here, that I failed to meet with it around the hills at Tirith Laki, below Sehwan, and also further south in the Surjana hills.

I first met with it at Khebar, Hyderabad district, in March 1929, where I came across a pair feeding in a babul *huri*.

A few days later a single bird, a female, was seen feeding on a roadside *kandi* tree between Saidabad and the Kot of Pir Jhandowallo.

In Upper Sind, I failed to meet with it in the Sukkur, Upper Sind Frontier and Larkana districts, though I spent four summers in Sukkur and one in Jacobabad.

On the 18th March 1934 I again came across it, meeting a bedraggled female feeding on a roadside babul between Daro and Laikpur on the Pinyari canal east of the Indus, in the Karachi district.

The general condition of the bird and the presence of a marked incubation patch clearly indicated that the bird was a brooding female. The nest however could not be located.

At Jhok, a few miles south east, on the 22nd of the same month, I found a nest containing three callow young, in a roadside babul tree.

The nest was about 15 feet high and the entrance, which had obviously been cut by the birds themselves, $1\frac{1}{8}$ inches in diameter. The young were being fed by both parents. Grubs and insects were evidently plentiful as the adult birds were seldom away from the nest for a period longer than 15 minutes.

A pair of Rose-ringed Paroquets (*Paleaornis torquata*) had a nest on the same tree and, one of them, the male, who perched on one occasion rather close to the woodpeckers' nest was fiercely attacked and driven off by the male woodpecker.

At Mirpur Bathoro, about 8 miles south of Jhok, I found five nests between the 23rd and 27th of March 1934.

The nests which were all on babul trees and situated from 20 to 30 feet high, contained either young or eggs, or were in the making, both sexes sharing the labour of wood cutting.

At Musani and Jati, further south, between the 3rd and 7th April I again met with it along the banks of the Pinyari, Gadap, Gungroo and Sher Khan canals, and found several nests, either in the making or containing young or well incubated eggs. All nests, which were from 20 to 30 feet high, were in babul trees, and as a rule were cut in a partially decayed branch or trunk.

West of the Indus, I have met with this woodpecker at Ghora Bari and Mirpur Sakro, in the Karachi district.

At the former place I came cross a pair on the 10th December 1934 feeding on babul trees on the banks of the Nasir canal near Sanwalpur and at the latter, a pair was met with feeding on babul trees on the banks of the Jaro canal on the 15th of the same month.

On the 9th October 1935, a pair was met with feeding on roadside babul and *kandi* trees near Sakrand, on the borders of the Nawabshah and Hyderabad districts.

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In December the same year however, I was encamped at Sakrand for 9 days but failed to locate it again.

At Mirpurkhas, Thar Parkar district, on the 22nd March 1936 I came across a pair feeding on babul and *kandi* growing alongside the Jodhpur Railway embankment, but was unable to follow up my find as I was under transfer to Karachi and left Mirpurkhas the day following.

This woodpecker is very partial to dry open country, away from which it is seldom met with.

In such tracts east of the Indus, drained during the Abkalani season by the Pinyari canal and its many distributaries, in the Karachi district, it is common and a permanent resident, elsewhere I am inclined to believe that it occurs only as a straggler, except perhaps in the Thar Parkar district, where it may breed in the drier parts of the Nara valley, and in the lower portion of the Hyderabad district adjoining the Jati and Mirpur Bathoro talukas of the Karachi district, where it is abundant

It is common in Cutch, whence it probably extended to Sind, following in main, from about Lakhpat, the courses up stream of the Pinyari and Eastern Nara canals.

Like other members of the family it mates for life and hunts in couples.

When the young are able to fly the family keeps together for a considerable time and the young are apparently driven off by the parent birds only on the approach of the mating season, which begins early in March.

The habit both sexes have of giving voice to fairly loud 'chucks' when feeding, gives the position of the birds away and once a bird is thus located its mate will invariably be found in the vicinity.

The birds apparently 'chuck' to each other to avoid being too widely separated, as no matter what direction a feeding bird takes, it is followed up by the other. At times the second bird arrives at a tree before the departure of the first, but following the leader systematically from tree to tree is not a hard and fast rule.

Invariably a general direction is taken, the birds keeping to separate trees and only occasionally meeting.

At Mirpur Sakro in December 1934 I noticed that a pair which had evidently bred in a babul tree in the compound of the Rest House the season previous, used to return daily at dusk and roost for the night in their old nest hole.

The entrance of the nest, which is always neatly cut, is invariably about the size of a rupee and though old nests are at times reoccupied, the birds as a rule prefer to cut out fresh nest holes each breeding season, as I came across many old nests, the majority in babul trees, a few in *kandi* and old *lai*, during my rambles along the banks of the Pinyari canal and its distributaries in the Mirpur Bathoro and Jati talukas of the Karachi district.

As a rule nests were cut in partly decayed trunks or branches. I never found a tenanted nest in a wholly dead tree.

Around Jhok, Mirpur Bathoro and Jati in the Karachi district this woodpecker more or less replaces the Sind Pied Woodpecker

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(*Dryobates scindeanus*) as I never met with both species in the same locality except at Mir Khano, where I came across a single pair of the latter, apparently stragglers, as I failed to find it again, though I met with quite a number of the former in the same locality and further south as far as Sandō Bunder, a few miles below Mughal Bin, the headquarters of the Jati taluka.

In Sind, as elsewhere, the full clutch of eggs laid appears to be three. I never found more than three eggs or young in a nest.

Eggs taken in Sind are inseparable from those taken in the United Provinces.

KARACHI. K. R. EATES, F.Z.S., M.B.O.U.

September 6, 1937.

XIX.—THE DISTRIBUTION AND NIDIFICATION OF THE ROCK HORNED OWL [*BUBO BUBO BENGALENSIS* (FRANKL.)] IN SIND.

The Rock Horned Owl though rare in the plains of Sind is not uncommon in the Kohistan or hilly tracts of the Province.

It is partial to arid, hilly localities, where there are numerous ravines and deep, dry watercourses. In such places I have not only met with it, but found it breeding in the Karachi, Sukkur and Thar Parkar districts. J. M. S. Culbertson found a nest containing four fresh eggs, late in December, at Badin in the Hyderabad district. The nest was a depression in the ground at the foot of a mango tree by the side of a canal. An exceptional situation for the nest of this owl, which is not as a rule found near water.

Only on one occasion have I come across it in the plains of Sind. This was in the Mirpur Mathelo taluka of the Sukkur district, where, on the 26th February 1930 I found a pair nesting in an old Kubh near Ghari Chakar.

The nest was placed in a window-like recess about 12 feet high, inside the Kubh and contained, besides a single egg on hatching point, some clods of earth, a few bits of dirty rag and a small stick or two. The female sat very close and only left her nest after a small clod of earth had been thrown at her. The male flew out of the Kubh as I entered. He had apparently been seated in a recess similar to the one in which the nest was situated, as the ground below was littered with castings and the feathers of a Roller and a Ring Dove. The pellets, when broken up, were found to consist chiefly of the bones of small rodents. Below the nest I found, besides castings and feathers, some pieces of egg shell, which from their size and texture were unmistakably of this owl. Apparently the other eggs, only one was in the nest, had been displaced by the brooding female and had rolled out of the nest, as the recess was not more than about a foot in depth horizontally.

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On the 18th March 1924 I found a nest containing two well incubated eggs, in a hole in the side of a deep, dry watercourse, in the hills west of Jungshahi in the Karachi district. The eggs were placed on the bare sand. The female sat close and was flushed off her nest by my approach and that of a Jokhio tracker, while we were following the spoor of a 'chink' along the bed of the dry nulla. The male was found perched on a *Khor* tree growing out of a clump of *Thuar* in a small ravine hardby. On the ground below were many pellets consisting chiefly of the bones of small rodents.

Again, on the 26th March 1931 in the Rohri Kohistan, near the ruins of the ancient city of Aror, in Sukkur district, I found a nest in the side of small ravine, overgrown with *Thuar* (cactus) and *Khor*, a species of *Acacia* which grows on stony hills in Sind. The nest contained two well grown young, one very much bigger than the other. Both parents were found in the same nulla, the female being flushed off her nest. The usual castings littered the ground below the nest and the *Khor* tree on which the male was seated. The pellets which were the usual, long, cylindrical ovals, about the size and shape of the egg of a Common Grouse, consisted, as those found on former occasions, chiefly of the bones of small rodents. Skull and maxillary bones with teeth intact being as before, very much in evidence. The nest, a hole about 2 feet deep and 18 inches in diameter was quite bare of any kind of lining and the entrance, which was below a large boulder, was partly concealed by a clump of dried, coarse grass.

As I approached the nest the young owls backed into their home, hissing alarm and making loud, snapping noises with their beaks. I took them to Sukkur, where they had the run of a back verandah and became very tame. About two months later however they suddenly sickened and died after a fortnight or so.

I was unfortunately unable to provide them with sufficient in the way of natural diet. Sparrows and mice they swallowed whole and made no bones about it. Though they greedily ate chopped, raw meat I am afraid that it eventually killed them, as when on this foreign diet, in the absence of birds, beetles, squirrels and mice, they made no castings for days and this disarrangement of Nature's working was, I am sure, the root cause of all their trouble. I was indeed sorry to lose Babbar and Takar, as I had named them. They made most interesting pets. More of them anon, as I hope some day to perpetuate their memory in an article devoted wholly to them.

On the 27th February 1936 I again found a nest, this time containing 3 young and an addled egg, in some sand bhits, about 6 miles north-east of Umarkot, in the Thar Parkar district. The nest, a hole about 2 feet deep and 18 inches in diameter, in the sloping side of a nulla, was partly concealed by a dried clump of Khip growing immediately above the entrance, and devoid of any kind of lining. The three young birds were all of different sizes. The biggest was quite three times the size of the smallest. The two older birds, one of whom was able to stand and walk and had its quill feathers sprouting, objected strongly to being handled

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and expressed their alarm and resentment, in the manner peculiar to owls, by making hissing noises and sharply snapping their powerful beaks. The youngest in fine down was just able to squat and balance itself precariously with the aid of its beak. The female sat very close and permitted me to approach within about 15 feet before she flew off. The nest inspite of containing 3 young was scrupulously clean. I found the male seated stolidly in a stocky *Khumbat* tree growing out of a dense clump of *Thuar* in a small ravine nearby, a bifurcation of the same nulla.

The feathers and feet of a Ring Dove were found at the entrance of the nest. Below, were the usual castings which consisted mainly of the head and jaw bones of small rodents.

Old castings littered the ground below a *Khumbat* tree, a species of *Acacia* which grows on sand bhits in the Thar desert, about 20 yards higher up the nulla, the presence of which told a tale and resulted in the discovery of the nest.

I was informed by Tharis that this owl is not uncommon in the sand bhits of Thar Parkar and a Kolhi tracker, who was with me at the time, told me that he knew of a ravine in some bhits about 8 miles south-east of Umarkot where a pair of these owls had had their home for years.

The ravine where the nest was found was about 12 miles, as the crow flies, from the nearest fresh water.

Since this owl has been found resident and breeding in Northern, Central and Southern Sind, both east and west of the Indus, it must also occur in the hills bordering the west of the Province, such as the hills around Pir Mangho, Khar, Surjana, Lakhi and the Khirthar range, besides isolated chains and groups scattered about the Province, such as the Makli ridge and the hills around Khadeji, Jhirruck, Pir Patho and Bram Hyderi, where there is suitable habitat for this owl.

Most places where the Rock Horned Owl is likely to be found are unfortunately off the beaten track of the touring official and the lack of water, food supplies, transport, fodder and communications, not to mention the intense heat, at times, even during the winter months are, in main, reasons why so little is known about this owl in Sind, as its domains are seldom encroached upon, except by ardent Shikaris after game, who have neither the time nor the inclination to bother about owls, even if they are 'horned'.

K. R. EATES, F.Z.S., M.B.O.U.

KARACHI.

November 26, 1936

XX.—OCCURRENCE OF THE CHINESE LESSER KESTREL (*CERCHNEIS NAUMANNI PEKINENSIS* SWINH.) IN NORTHERN BURMA.

In 1935 Mr. A. K. Thompson, Burma Frontier Service, sent me the unsexed skin of a Kestrel obtained in the Sumpralum Subdivision of the Myitkyina district. This proved, as I expected, to be

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Cerchneis naumanni pekinensis, and the skin which has been identified by Mr. N. B. Kinnear, is now in the British Museum.

The only previous known occurrence of this Kestrel in Burma was recorded by me in the *Journal* (November 15, 1932) when I obtained two males in April out of a large gathering in South Pegu.

LONDON J. K. STANFORD, I.C.S.

February 6, 1937.

XXI.—NOTES ON BIRDS OF PREY IN THE MADRAS PRESIDENCY.

Haliaëtus leucogaster (Gmel.) The White-bellied Sea-Eagle.

In volume xxxviii, No. 3, mention is made of this bird in the account of the Vernay Scientific Survey of the Eastern Ghats and the uncertainty regarding its distribution along the coast line of the Madras Presidency.

I have recorded the presence of this bird on Rameswaram Island and the Pamban Pass during all the months of 1930 excepting April, the greatest number being seen from September to November. I was unable to find any evidence of the bird nesting on the Island.

Further records have been kept by me from 1933 to 1935 of a pair which have nested at Cuddalore, the information collected is reproduced in the form of notes for easy reference.

28-11-33. Nest on a pipal tree about a mile inland and at a height of about 40 feet from the ground. One egg, fresh, white in colour stained with dirty yellowish and brown streaks which do not wash off. Size 2.73″ × 2.06″.

The birds were watched until 15-12-33 but did not lay again. The whole nest including a large part of the tree being blown down by a severe cyclone on that date.

22-11-34. The same pair it is presumed built a new nest, again on a pipal tree, about 200 yards away from the former one. This nest was about 30 feet from the ground and was not quite as large as the previous one. One egg, fresh, similar to the previous one, size 2.84″ × 2.05″.

15-2-35. Nest examined again as both parent birds were seen in the vicinity continually from 22-11-34. The nest contained one fledgling about the size of a country fowl. Remains of fish were seen on the ground below the nest, also a fresh sea snake about 18 inches in length. The parent birds merely flew round and did not attempt to attack the man who climbed the tree.

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15-11-35. Both birds seen at the nest which was being reconditioned by them.

8-12-35. One bird seen sitting low on the nest. It was presumed the egg had been laid. One young one hatched and seen sitting in or on the edge of the nest during January 1936. This young one was seen during February sitting on or near the nest and was by that time practically the size of the parent birds. The colouring was not nearly so clear or defined as in the parent birds.

Both eggs taken are with me and are available for the museum collection if of interest.

Circaëtus ferox (Gmelin). The Short-toed Eagle.

In the account of the Vernay Scientific Survey of the Eastern Ghats, Part xiii, in Volume xxxviii, No. 3, of the *Journal* mention is made of only one record being available of this bird's nest being taken by Stewart in Travancore. Nothing further appears to be known of its habits in the Madras Presidency and in order to remedy the omission this note is submitted of my observations of the bird, its nest and the single egg obtained by me on 11-1-34. near Vallam Ridge at Tanjore. The nest, which was unusually small for the bird, was situated at about 12 feet from the ground on a thick and very thorny babool tree in scrub jungle. The materials used in the construction consisted of small dried twigs, the inside lining being of thinner twigs and some green mango leaves which had dried after being placed in the nest.

The bird under observation, one only having been seen, was a close sitter and although some stones were thrown at the nest that day it was found the bird merely raised itself in the nest and then settled down. The following day when the egg was taken the bird only left the nest when the men commenced chopping away the thorny twigs to enable them to climb the tree.

The single egg, which measures 3.00″ × 2.28″, was pure white and devoid of any gloss.

TANJORE. C. H. BIDDULPH.

February 9, 1937.

XXII.—UNUSUAL SITE FOR THE NEST OF THE WHITE SCAVENGER VULTURE [*NEOPHRON PERCNOPTERUS GINGINIANUS* (LATH.)].

A Scavenger Vulture was observed carrying nesting material early in February 1934 and on being watched the partly built nest was found on a termite hill situated in the waterspread of an irrigation tank. The termite hill was about five feet in height and was divided into two or three points at the top, the nest being situated between these points.

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The site was quite exposed from every direction and the ground in the vicinity was not so wet as to prevent an easy approach to the nest.

The first egg, which was laid on 22-3-34, was taken immediately as it was feared that cowboys would destroy the nest and eggs. The egg which measured 2.80″ × 2.00″ was a very fine example of the reddish-white type profusely blotched with red brown.

Although the nest was watched for weeks no further eggs were laid, nor did the birds lay in the same nest in 1935. A pair of these birds did nest on a banyan tree on the tank bund nearby and I took two fresh eggs on 22-2-35.

The date is interesting as it is exactly a year later and I wonder if it may not be the same birds as nested in the tank bed in 1934?

These two eggs were faintly marked with fine red brown spots and measured 2.80″ × 2.00″ and 2.62″ × 2.00″.

TANJORE. C. H. BIDDULPH.

February 9, 1937.

XXIII.—BEHAVIOUR OF JERDON'S LITTLE RINGED PLOVER (*CHARADRIUS DUBIUS JERDONI* LEGGE) WITH YOUNG.

On the 21st March 1925 while working the banks of the Gogra river near Magarsee, Fyzabad district, I came across a pair of these birds on an unfrequented sand bank about 50 yards from the main stream.

The female on sighting me became very restless and tried her utmost to lead me away by running off in a direction directly opposite to that in which her nest was later located. As I approached the spot where both birds had originally been seen she became more and more agitated. Suddenly with a 'cheep' 'cheep 'che—ep', She took to wing playing the part of the proverbial damsel in distress exceedingly well. She fluttered along the ground, her tail spread, fanwise, downwards, shamming a broken wing, fluttering low, hesitating, shambling, pausing every few seconds to see if I was following her. I did follow her for a while, to see how far she would take me from her nest. She took me on gaily, keeping about 20 yards ahead the whole time, increasing or slackening her speed according to mine in order to keep her lead. After proceeding thus for about 100 yards I stopped. She continued her antics for a while, but finding that I was not following her, she stopped and after a moment or two, suddenly flew up with a sharp cry, took a swift half circle to my left, settled about 100 yards away and ran in a bee-line to a spot where lumps of dried blue-bull droppings were lying about and sat down quietly, settling herself in the sand. Her mate, who had run off in a different direction, uttering short, sharp cries, now stood and

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viewed the proceedings from a small sand ridge about 80 yards away, uttering an occasional, woeful 'cheep'.

I rooted my eyes to the spot where the female had settled herself, she was now quite invisible to the naked eye, and made straight for the place. As I approached I noticed her slipping off in a crouching position, just a momentary glimpse through the corner of my eye, as I dared not take my eyes off the exact spot where she had settled, and there I found on the edge of a small sandy depression, in the midst of scattered lumps of dried Nilgai droppings, a slight scraping, in which lay crouched two nestlings in down and an addled egg. The nest was devoid of any kind of lining. The tiny chips of drift wood or bits of dried grass or roots at times found in the nest of this Plover were quite absent.

The mottled nestlings lying with necks outstretched against a sandy-clay background were an ideal example of protective colouring and blended so well with their surroundings that a close inspection alone could distinguish them.

The young chicks, which could not have been more than a few hours old, as the egg shells were still in the nest, remained perfectly passive, permitting me to remove the addled egg and broken egg shells without making the slightest movement. They appeared to freeze instinctively and remained without any visible movement even when touched lightly with the tips of my fingers.

The parents remained some distance away, about 60 yards, making short agitated runs and uttering plaintive cheeps. I then moved away in an opposite direction to the parent birds, sat down in the sand about 40 yards away from the nest and waited developments.

The female was the first to approach her chicks, she settled about 10 yards from them and after a little hesitation made straight for them, uttering short, plaintive cheeps. The male meanwhile once again became very excited and did his utmost to lead me away from the nest by running off in an opposite direction and playing the broken wing game to perfection. I however paid not the slightest heed to his frantic efforts to entice me away and continued closely to watch his mate through prismatics. She went right up to her chicks but in place of settling over them as expected, she uttered low, twittering cries and to my surprise and interest, both chicks found their legs and tottered unsteadily after her, answering her calls with feeble 'peeps' and doing their little utmost to keep up with her. She led them a few yards from the nest and sat down with them in some sprouting tamarisk about four to ten inches in height, and there settled herself. Though now out of sight, I could still hear the faint 'peep-peep' of her chicks, which gradually died down to an occasional 'peep' and finally to complete silence.

The male meanwhile recovered his normal balance and after preening himself for a while began to feed on the sand bank, moving away from the spot where his mate had taken and concealed their chicks. I moved closer to the concealed female and when about twenty yards off noticed her slink away crouchingly through the sprouting tamarisk and take to wing about ten yards

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from her concealed young. She repeated her broken wing tactics, which were taken up by the male, who became more excited on this occasion than his mate, almost throwing himself into convulsions in his frantic efforts to attract my active attention, fluttering and rolling in a direction opposite to that taken by his mate. I went up to the patch of cover and found both chicks again frozen into immobility, lying side by side in the shelter of the sprouting tamarisk, necks stretched out, flush with the ground, eyes open, without the slightest movement, a part of the sand on which they lay as immobile as stone, and, so I left them. I once again moved away, but this time a good hundred yards and watched the scene through binoculars. The male soon joined his mate, alighting a few feet from her. She then moved off and after a moment or two flew directly to her chicks, and appeared to settle down. Shortly after she came out into the open and began feeding quietly a few yards from her mate, apparently satisfied that the strange human had come and gone in peace, and so I left them and their charming wee chicks.

K. R. EATES, F.Z.S., M.B.O.U.

KARACHI.

November 26, 1936.

XXIV.—INTERGRADATION OF THE RACES OF THE SPOT-BILLED DUCK (*ANAS POECILORHYNCHA* FORSTER).

By separate parcel post I send the skin of a duck which I recently shot. Could you very kindly tell me what species the duck is. It was shot on 25th November 1936 on a backwater of the Somkong river at the western end of the Pasighat subdivision of the Sadiya Frontier. The duck was in company with some Mallard and Gadwall and appeared to be the only one of its species in the flock from which I shot it.

PASIGHAT,
N. E. FRONTIER,
ASSAM.

R. E. PARSONS,
Astt. Political Officer.

December 10 1936.

[The duck obtained by Mr. Parsons is a spot-billed duck (*Anas poecilorhyncha*) but as it could not be exactly identified with the typical form, or with the Burmese race (*A. p. haringtoni*) or with Eastern form (*A. p. zonorhyncha*), we submitted it to Stuart Baker who writes: 'The skin of *Anas poecilorhyncha* which you have forwarded to me is a most interesting one. It is exactly intermediate between *A. p. zonorhyncha* and *A. p. haringtoni*. Like the former, it has no posterior wing-bar but, like the latter it has a *green* speculum (as also in *poecilorhyncha*) and not purple-blue as in *haringtoni*.

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As specimens of *A. p. haringtoni* have been obtained in Assam which were quite true to type I should prefer to call this particular specimen an aberrant *haringtoni* rather than an aberrant *zonorhyncha*, though either term would apply equally truly.

I obtained specimens of this duck in the Dibrugarh District (*J.B.N.H.S.*, vol. xxii, p. 850) as did others, while Stevens shot a fair number in North Lakhimpur (*ibid* vol. xxiii, p. 743).

The great point of interest in this individual is the way it shows how geographical races tend to vary in the direction of those nearest to them in geographical distribution.'—EDS.]

XXV.—OCCURRENCE OF MALLARD (*ANAS PLATYRHYNCHA* LINN.) AT HOSHANGABAD.

On January 8th 1937 I saw seven mallard (*Anas platyrhyncha*) on a jheel in the Hoshangabad district of the Central Provinces and watched the birds through binoculars and eventually shot one, a drake. There were 2 drakes and 5 ducks. I understand that the mallard is a rare visitor to the Central Provinces. The abnormally cold weather of January 1937 perhaps accounted for this unusual migration.

HOSHANGABAD, J. MILES STAPYLTON.
February 6, 1937.

XXVI.—THE NUKHTA OR COMB DUCK (*SARKIDIORNIS MELANOTOS* PENNANT) IN ASSAM.

On the 11th instant I came across three of these birds, they were separated from each other, only one being within range, which I promptly bagged, a young drake. The other two went off after my shot. On looking up Stuart Baker's book on 'Indian Ducks' I find he mentions these birds having been found in Cachar, Sylhet and the North Lushai Hills, but makes no mention of Assam itself.

On referring this particular instance to Mr. John Higgins, our Commissioner and a well-known authority in Assam on such feathered game, he writes to say 'I have never heard of a Nukhta in the Assam Valley. I saw two that had been shot on the Loktah lake in Manipur in cold weather 1911-12-, etc.'

I shall be glad to hear through readers of your *Journal*, in Assam whether they have seen or heard of this duck being shot.

NAGAGHOOLIE TEA ESTATE, W. M. LE MARCHAND.
OAKLANDS, P.O., DIBRUGARH, T.O.
February 19, 1937.

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XXVII.—OCCURRENCE OF THE GREAT-CRESTED GREBE (*PODICEPS CRISTATUS CRISTATUS* L.) AT MAYMYO, UPPER BURMA.

A single bird was seen on the lake at Maymyo, 3,500 ft., in Upper Burma, on the 8th March 1937. It stayed for four days, sitting most of the time in a patch of reeds growing up out of the water in the middle of the lake. It was first spotted by Major Sullivan of the Burma Rifles, who pointed out the bird to me. Records of this bird are few enough to make it worthy of mention. Previous records in Burma are listed by Stanford (*Ibis*, April 1935, p. 279).

MAYMYO, P. F. GARTHWAITE, B.F.S.

March 14, 1937.

XXVIII.—BIRDS AND ANTS.

I can give another example of the action referred to in Note xxv on pages 624-631 of vol. xxviii. When in Shillong on 15th June 1924 I was in the bungalow and in the evening watched a Drongo, which flew down onto the ground on the path outside the window, and was picking up ants. It picked up an ant in its beak and then applied its beak to the root of its tail (and occasionally also beneath its wings, so far as I could see) and then swallowed the ant. It repeated this performance for quite five minutes.

RODBOROUGH FORT, T. BAINBRIGGE FLETCHER.

STROUD, GLOS.

January 17, 1937.

XXIX.—A BLOODSUCKER (*CALOTES VERSICOLOR*) ATTACKING AN ADULT BIRD.

Such an attack was recently observed by me and as the circumstance was considered unusual it was decided that it may be worth recording.

While walking along an irrigation channel bund one evening the noise made by two larks and their behaviour caused me to stop and watch what was a serious battle between them. One bird slightly depressing its wings and moving its head up and down advanced towards the other, which on its part backed away although in the same attitude and just as prepared to fight.

Unobserved by me the bloodsucker, which was a largish male, suddenly darted out from some small bushes when the larks met and were rolling about together, having as it seemed their beaks locked. He grabbed one of the birds by the primaries, but almost immediately lost his grip as the bird fluttered away.

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The bloodsucker moved away about a yard and settled down within sight of both the larks which within a minute or two resumed the fight, apparently quite indifferent to the fact that their attacker was so near.

The fight between the birds was very shortly after interrupted by some urchins coming up to see what I was watching.

Instances are known of bloodsuckers visiting nests of small birds and eating the eggs and nestlings and it may even be possible for them to catch and kill fledglings of the smaller species of birds, but in this instance it would appear that the bloodsucker actually attempted to secure a fully grown bird and it is wondered what he would have done with it even had he succeeded in killing it.

TANJORE. C. H. BIDDULPH.
February 9, 1937.

[Swallowed it.—EDS.]

XXX.—THE BUTTERFLY (*RHINOPALPA POLYNICE BURMANA*) IN THE N.-E. FRONTIER, ASSAM.

It may be of interest to readers of the *Journal* to know that—although it is reputed to be rare and is stated to be so in in Brigadier W. H. Evans' book *The Identification of Indian Butterflies*—the butterfly *Rhinopalpa polynice burmana* is, I have happened to discover, most exceedingly common in a narrow strip of country about ten miles long by about two miles wide near here. I have not succeeded in finding the larvae; but from June to September during breaks in the monsoon, when it is fine and warm, this strip of country literally swarms with this butterfly and a dozen perfect specimens can very often be netted almost without moving one's feet. I do not know if the fact that it is so common is in any way extraordinary; but I write in case it is. I recently sent a specimen of this species to the Society and you very kindly confirmed my identification.

R. E. PARSONS,
PASIGHAT, N.-E. FRONTIER, ASSAM. *Assistant Political Officer.*
March 7, 1937.

XXXI.—CURIOUS BEHAVIOUR OF A WASP.

While at work recently in a railway carriage provided for my use I noticed a small wasp enter one of the half-open windows carrying a ball of clay with which it proceeded to work on an egg cell on one of the venetian shutters. By the side of this cell and about an inch away from it was a crescent-shaped mass of clay, presumably the beginning of a second cell.

Later when looking at the venetian shutter to see how the wasp had progressed I noticed that it had made similar attempts at

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cell construction on three other shutters on the same side of the carriage. The cells in each case were similarly situated (i.e.) on the left side of the shutter and on the fourth cross piece from the top in three shutters and on the second from the top in the fourth. It was also observed that it was at work on two cells at the same time on three shutters, while in the fourth it had just commenced on one cell.

The carriage had been on a siding for some days with all the venetian shutters up and in consequence being practically dark it would appear that the wasp had entered through some opening each time and had worked, but practically every time on a different shutter.

On occupying the carriage all the shutters were kept half open and in the bright light the wasp had concentrated on the same shutter and had completed one cell by the afternoon but had not commenced filling it with caterpillars or spiders when the carriage had to be moved and in consequence a very interesting observation was interrupted.

The points that strike one in the above are:—

(1) The fact that the wasp had not noticed that it was working on four shutters simultaneously.

(2) That it had at times come to shutters on which there were no signs of its previous work and this fact had not been noticed.

(3) The way in which it had located the two cells is practically the same spot on each shutter (i.e.) on the left side and on the fourth cross piece in three cases.

(4) The fact that having got three pairs of cells exactly similar in location it had made a mistake with the fourth.

(5) That it had never gone to any of the windows on the opposite side of the carriage.

(6) That it was working on two cells on each of three windows at the same time, the cells being not more than an inch to an inch and a half apart.

(7) The fact that once it had the carriage reasonably lighted it did not work on any of the cells on the three remaining windows.

I regret not having secured the wasp for identification, but at the same time this is considered of little importance as my note is not an attempt to impute such behaviour as peculiar to a particular species of wasp, but rather to point to the idiosyncrasy of the wasp under reference.

Further observations:—

On 21-10-36 my carriage was again at Kumbakonam, having been there for three days on the same siding. On inspection of the windows it was found that there were then seventeen partly built cells on the first shutter, eighteen on the second shutter, eleven on the third shutter; all situated on the last four cross pieces of the venetian shutters. The fourth shutter had three partly built cells, two being on the last two cross pieces and one on the fifth cross piece from the bottom.

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All the above cells were on the same shutters as were used previously and had been built by the wasp in three days. The time interval between the two observations being approximately six weeks.

It would appear that the fact that the same carriage was used and exactly the same four shutters, that it was the same wasp, but what does not seem clear is how the wasp after a lapse of six weeks was still alive and in the condition to construct so many egg cells.

TANJORE. C. H. BIDDULPH.

February 9, 1937.

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PROCEEDINGS OF THE ANNUAL MEETING OF THE BOMBAY NATURAL HISTORY SOCIETY.

The Annual General Meeting of the Society was held at the Prince of Wales' Museum (New Wing) on Thursday the 18th March 1937 at 6-15 p.m. The Hon'ble Sir Robert Bell, K.C.S.I., C.I.E., I.C.S., was in the chair.

AGENDA.

1. Reading of the Annual Report of the Committee.
2. Presentation of the Balance Sheet and Statement of Accounts for the past year.
3. Election of the Committee.

Mr. P. M. D. Sanderson, Honorary Secretary, announced the election of the following 68 new members since the last Annual Meeting.

Mr. F. C. Badhwar, Calcutta; Mr. Noel Exshaw, France; Mr. E. J. Langleson, Bombay; Mr. H. E. Burgess, Coonoor; Mr. Mg. Tun Yin, Rangoon; Mr. M. R. Gokarn, Kalyan; Miss Winifred H. Baker, Lahore; Mr. M. G. Champion, Roorkee; Capt. G. McElligot, Bombay; Mr. U. B. H. Dunbar, Burma; Mr. Jal. N. D. Tata, Bombay; Mr. P. M. Hubbard, Dera Gazi Khan; Mr. Ralph Sasson, Calcutta; Capt. G. K. Graham, Miranshah; H. H. The Maharaja of Mayurbhanj, Baripada; Mr. L. N. Bhagvat, Bombay; H. H. The Heir-Apparent of Malerkotla, Punjab; Mr. Tun Kyan, Burma; Mr. G. A. Hodson, Burma; The Librarian, Museum of Comparative Zoology at Harvard College, U.S.A.; Mr. W. McF. Russell, Bombay; Mr. R. G. Griffith, Calcutta; The Belgaum Club, Belgaum; The Chief Saheb of Miraj, Jr., Miraj; Miss Meherbai P. M. Dalal, Bombay; Mr. H. A. Maxwell, Rangoon; H. H. The Raja Saheb of Akalkot, Akalkot; Mr. J. N. Corbett, Ceylon; Mr. C. S. Iron, Coorg; Mr. D. F. F. Chisholm, Calcutta; Miss Perin P. M. Dalal, Bombay; Mr. R. A. Bailey, Jubbulpore; The Principal, Shri Shivaji Preparatory Military School, Poona; The Mahableshwar Club, Mahableshwar; H. E. Sir John Hubback, K.C.S.I., I.C.S., Governor of Orissa; Rev. E. G. Nichols, Madura; Dr. F. E. R. Laborda, Calcutta; Mr. C. H. Biddulph, Tanjore; Mr. V. N. ff. Powell, Bandiqui; Mr. A. A. Marr, Calcutta; Mr. H. E. Richardson, Tibet; Kumar Amar Singh, Gaya; Mr. A. E. G. Davy, Ferozepore; Mr. A. C. Cotton, Sholayar; H. E. The Most Hon'ble Marquess of Linlithgow, Viceroy of India; Mr. Rolf Benkert, Bombay; Mr. G. Ahmed Khan, Aurangabad; Mr. P. W. Craker, Asansol; Mr. A. I. R. Stevenson, Shillong; Capt. S. W. A. Love, Shillong; Capt. A. V. Morton, Bombay; Major H. G. Rossel, Meerut; H. H. The Maharana of Lunawada; Mr. S. D. Bamjee, Asansol; Major C. L. B. Duke, Dehra Dun; Mr. G. Warren, Assam; Mrs. Victor Noel-Paton, Bombay; Mr. R. D. Sethna, Poona; Mr. C. G. Demetriadi, Calcutta; Mr. G. D. L. Millar, Assam; Mr. J. A. M. Symns, Burma; Dr. B. M. Joly, Agra; Capt. C. I. Boyle, Agra; Mr. D. G. Meston, Assam; Mr. W. B. Cooke, Valparai; Dr. B. A. Lamprell, Assam; Mr. J. Thackeray, Assam; Capt. H. F. Walker, Bombay.

The following proposal was accepted :—

Vice-President.—Rt. Rev. R. D. Acland, Lord Bishop of Bombay, in place of the Hon'ble Sir Robert Bell, K.C.S.I., C.I.E., I.C.S.

Executive Committee.—Mr. A. Forrington, Mr. C. G. Freke, C.I.E., I.C.S., Mr. D. G. Hill, Lt.-Col. C. G. Toogood, D.S.O., Dr. S. A. Wilkinson, M.R.C.S., L.R.C.P.

BOMBAY NATURAL HISTORY SOCIETY.

OFFICE BEARERS—1937.

Patron.—His Excellency the Viceroy of India.

Vice-Patrons.—H. H. The Maharao of Kutch, G.C.S.I., G.C.I.E.; H. H. The Maharaja of Jodhpur, K.C.S.I., K.C.V.O.; H. H. The Maharaja of Rewa, K.C.S.I.; H. H. The Maharaja of Bhavnagar; H. H. The Maharaja of

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Travancore, G.C.I.E.; H. H. The Nawab of Junagadh, K.C.S.I.; Mr. F. V. Evans, Liverpool; Sir David Ezra, KT., F.Z.S., Calcutta; Mr. A. S. Vernay, New York and London; Lt.-Col. K. G. Gharpurey, I.M.S. (Retd.).

President.—H. E. The Right Hon'ble Lord Brabourne, G.C.I.E., M.C.

Vice-Presidents.—H. H. The Maharao of Kutch, G.C.S.I., G.C.I.E.; Rev. Fr. J. F. Caius, S.J.; Rt. Rev. R. D. Acland, Lord Bishop of Bombay.

Executive Committee.—Mr. H. D. Ash, Mr. Farrokh E. Bharucha, Sir Alwyn Ezra, KT., F.R.G.S., F.Z.S., Mr. A. Forrington, Mr. C. G. Freke, C.I.E., I.C.S., Mr. J. B. Greaves, J. P., Mr. D. G. Hill, Lt.-Col. S. S. Sokhey, I.M.S., Lt.-Col. C. G. Toogood, D.S.O., Dr. S. A. Wilkinson, M.R.C.S., L.R.C.P., Mr. P. M. D. Sanderson, F.Z.S. (Honorary Secretary), Mr. H. M. McGusty (Honorary Treasurer).

Advisory Committee.—Dr. C. F. C. Beeson, D.SC., M.A., I.F.S., Dehra Dun; Lt.-Col. R. W. Burton, I.A. (Retd.), Nilgiris; Mr. C. H. Donald, F.Z.S., Punjab; Dr. F. H. Gravely, D.SC., Madras; Mr. C. M. Inglis, B.E., M.B.O.U., F.Z.S., Darjeeling; Mr. R. C. Morris, F.R.G.S., F.Z.S., Mysore; Major E. G. Phythian Adams, F.Z.S., I.A. (Retd.), Nilgiris; Dr. Baini Prashad, D.SC., Calcutta; Mr. H. C. Smith, I.F.S., Burma; Mr. F. Wadia, Poona; and Mr. J. H. Williams, Coimbatore.

ANNUAL REPORT OF THE BOMBAY NATURAL HISTORY SOCIETY FOR THE YEAR ENDING 31ST DECEMBER 1936.

ADMINISTRATION

President.—H. E. The Right Hon'ble Lord Brabourne, G.C.I.E., M.C.

Vice-Presidents.—H. H. The Maharao of Kutch, G.C.S.I., G.C.I.E., The Hon'ble Sir Robert Bell, K.C.S.I., C.I.E., I.C.S., Rev. Fr. J. F. Caius, S.J.

Executive Committee.—Right Revd. R. D. Acland, Bishop of Bombay, Mr. H. D. Ash, Mr. Farrokh E. Bharucha, Rev. Fr. J. F. Caius, S.J., Sir Alwyn Ezra, KT., F.R.G.S., F.Z.S., Mr. C. G. Freke, C.I.E., I.C.S., Mr. J. B. Greaves, M.L.C., Mr. H. McGusty, Lt.-Col. S. S. Sokhey, I.M.S., Mr. A. Forrington (*Honorary Treasurer*), Mr. P. M. D. Sanderson, F.Z.S., *Honorary Secretary*, Bombay.

Advisory Committee.—Dr. C. F. C. Beeson, D.SC., M.A., I.F.S., Dehra Dun; Mr. T. R. Bell, C.I.E., I.F.S. (Retd.), Karwar; Lt.-Col. R. W. Burton, I.A. (Retd.), Coonoor; Mr. C. H. Donald, F.Z.S., Dharamsala; Dr. F. H. Gravely, D.SC., Madras; Mr. S. F. Hopwood, I.F.S., Rangoon; Mr. C. M. Inglis, B.E., M.B.O.U., F.Z.S., Darjeeling; Mr. R. C. Morris, F.R.G.S., F.Z.S., Coimbatore; Major E. G. Phythian Adams, F.Z.S., I.A. (Retd.), Nilgiris; Dr. Baini Prashad, D.SC., Calcutta; Mr. H. C. Smith, I.F.S., Burma; and Mr. J. H. Williams, Coimbatore.

Staff.—S. H. Prater, M.L.A., J.P., C.M.Z.S. (*Curator*); C. McCann, F.L.S. (*Assistant Curator*).

THE HONORARY SECRETARY'S REPORT FOR THE YEAR 1936.

The Society's Journal.—The Thirty-eighth Volume of the Journal was completed and Part I of Volume XXXIX was issued during the year.

MAMMALS.

Foxes of British India.—Papers on Mammals include Pocock's revision of the genus *Vulpes*. Blanford in his *Mammalia* recognised 5 species of Foxes as occurring in India. Pocock reduces the number to 4. The author considers that the Fox of the Himalayas and the Desert Fox are not distinct species but merely local races of the Common Fox of Europe (*Vulpes vulpes*). To the Himalayan Fox (*Vulpes alopex* of Blanford), he assigns the name *Vulpes vulpes montana* Pearson and to the Desert Fox (*V. leucopus*), the

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name *Vulpes vulpes pusilla*. A third race of the European Fox found in our limits is Blanford's Fox (*V. v. griffithii*) which ranges from Afghanistan as far east as Murree. The remaining three species of foxes found in Indian limits are the Indian Fox (*Vulpes bengalensis*), the small Afghan Fox (*Vulpes cana*) and the Tibetan Desert Fox (*Vulpes ferrilatus*). Of these three species the Indian Fox is the only fox indigenous to this country. Like the forms of the European Fox inhabiting the Himalayas and North Western India, the others are immigrants from the North and West which have not penetrated far into India proper.

The Blue Bear.—Among the contributions to the Society's Museum received during the year is the skin of the rare Blue Bear (*Ursus arctos pruinosus*), which was presented by Capt. R. K. M. Battye. The animal was said to have been killed near Hor in Eastern Tibet. A description of the specimen was published by Mr. Prater in Volume XXXVIII, No. 3. It is the skin of an immature animal and in general coloration resembles the skin of an immature male from the Minshan Mountains, U. Kansu, presented to the British Museum by Capt. Fenwick Owen and described by Pocock (*Journ. Bom. Nat. Hist. Soc.*, vol. xxxv, p. 809).

Leopard and Tigress.—A number of interesting notes on Mammals were contributed by members during the year. Among them is a note by Iftkihar Ali Khan, Heir Apparent of Malerkotla State recording a curious association between a leopard and a tigress, which as suggested by the editors, may have been brought about by the mating of these two animals. The larger Felidae have frequently interbred in captivity. Opportunities for such interbreeding under natural conditions must be rare, but the facts of the case as recorded suggest the possibility.

Horn replacement in Nilgai and Black Buck.—Mr. Hall's note on horn replacement in Nilgai and Black Buck appears to confirm the observations of Buffon and Ogilby on the subject of horn replacement in certain bovines and antelopes. The theory is that a new horn grows within the sheath of the older horn which is displaced, cracks and peals off. Mr. Hall's note elicited confirmatory evidence from a number of correspondents. The whole question raises an interesting point for further observation.

The degeneration of tusks in the Asiatic Elephant.—Correspondence which passed between Sir Frank Colyer and Mr. R. C. Morris brings into prominence the fact that the tusk in Indian Elephants is a degenerate organ and suggests that the trend of evolution in these animals is towards the development of a tuskless form. This is a condition almost established in the Elephant in Ceylon, while a similar tendency in the Indian Elephant is revealed in the number of males which fail to develop tusks and the number of elephants born with a single tusk or which develop one tusk only after shedding the milk 'tushes'. It is apparent that the two existing species of elephants—the African and Indian are merging into a number of forms. There is the long-trunked Sumatran elephant, the hairy Malaysian mountain form, and the tuskless Ceylon Elephant. In the African Elephant, divergence from type seems

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to centre in the form and size of the ears. It is probable however that under existing conditions, both the Indian and African species will become extinct before enough time has elapsed for any striking new forms to be established.

Birds.

Birds of the Madras Presidency.—Messrs. Whistler and Kinnear continue their papers on the Avifauna of the Madras Presidency, based on the collections made during the Vernay Scientific Survey of the Eastern Ghats. Parts xiii and xiv were published during the year. They cover the Birds of Prey, Pigeons and Doves, Game Birds and Waders. Two new races are described among the Birds of Prey—The Ceylon Crested Goshawk (*Astur trivirgatus layardi*), distinguished from the South Indian form by its smaller size and markings, and a West Himalayan form of the Besra Sparrow Hawk (*Accipiter virgatus kashmiriensis*) distinguished from the east Himalayan race by its paler colouration. Two new races of the Jungle Bush Quail (*Perdicula asiatica asiatica*) are recognised and described. *P. a. ceylonensis,* is a richly coloured Island race from Ceylon and *P. a vidali,* found along the Malabar coast, differs from the typical form in the deep reddish tinge of its whole upper plumage. The authors disagree with the view put forward in the *New Fauna* that the Rock Bush Quail (*P. argoondah*) is a race of the Jungle Bush Quail (*P. asiatica*). They revert to the view held by Blanford and Oates that the birds represent two distinct species. Since the publication of his review of the various races of Scimitar Babbler (*J.B.N.H.S.*, vol. xxxv, p. 72) Mr. Whistler has been able to examine a series of skins of this species from the Billigirirangan Hills which confirms his view that the birds of the Lower Eastern Ghats are distinct both from the typical race and from the race found in Travancore. The new Eastern Ghats race he describes under the name *P. horsfieldi maderaspatensis.*

Birds of Travancore.—Parts iv, v and vi of Mr. Sālim Ali's Ornithology of Travancore were published. The author's interesting ecological notes on the species listed by him enhance considerably the value of his contribution. New forms described in his reports, which are written with the collaboration of Mr. Whistler are:—The Travancore Weaver Bird (*Ploceus p. travancoreensis*), Waite's Pipit (*Anthus rufulus waitei*), a pale sandy coloured race from the desert and drier areas of North Western India, and the Punjab Sky-Lark (*Alauda gulgula punjaubi*), which differs from the typical form in its markedly paler coloration. The recognition of these northern races is based on the study of material made available as a result of various surveys organised by the Society since the publication of the *New Fauna.*

Birds of Bombay and Salsette.—Since the publication of EHA's classic book on the Common Birds of Bombay, a considerable advance has been made in our knowledge of the classification and distribution of Indian Birds. Messrs. Sālim A. Ali and Humayun Abdulali have undertaken the production of an up-to-date list of the Birds of Bombay and Salsette. The list which contains notes on field identification and habits of species is being issued as part

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of the series of pamphlets on the Fauna of Bombay and Salsette, published by the Prince of Wales' Museum. The work will provide a useful guide to students interested in the bird life of Bombay and its suburbs.

Other articles on birds include Major Bates' account of his collecting trip in the Kishenganga Valley, a little known area ornithologically and two contributions on the Indian Crested Swift, one by E. H. N. Lowther and the other by J. K. Stanford and H. C. Smith. Mr. Lowther's paper is illustrated by a series of unique photos taken by the author.

Additions to the Indian Avifauna.—In his notes on Rare Birds from Burma, Mr. Stanford records obtaining a specimen of the Brown Suthora on the Myitkyina-Yunan Border. According to Dr. Ticehurst, the specimen conforms to the Yunan race—*Suthora unicolor canastes* and, as such, is a new form to the Indian avifauna. Mr. C. E. Milner shot a Shrenk's Bittern (*Ixobrychus eurythmus*) on the Moulmein-Kyaikmaran Road in the Amherst District, Tenasserim. The species has never been previously recorded from Indian limits. To the two previous records of the occurrence of the Long-tailed Duck (*C. hyemalis*) in India we have now to add a third: a female obtained by Mr. Lambrick at Drig in Sind in December 1935.

Wanted information about Cuckoos.—We should like to draw attention to Mr. Stuart Baker's appeal for information about Cuckoos. There are many problems connected with the parasitic habits of these birds which await solution. Apart from the question of the cuckoo's method of depositing her eggs in inaccessible nests, there is the question of the method of ejection of the fosterer's egg. To what extent is this habit prevalent among Indian Cuckoos? Again, how do the fosterers solve the problem of rearing, when more than one cuckoo is raised in the nest? All these are interesting questions which can only be answered by careful recording of the life story of individual birds from egg to fledgling.

Another interesting point connected with cuckoos is raised by Mr. Livesey in his article on Cuckoo Problems. How has the approximation in colour and markings between the eggs of the cuckoo and her selected fosterer been brought about? Mr. Livesey looks elsewhere for a solution than the one offered by the theory of Natural Selection. He holds that design has played a considerable part in effecting this similarity, which he believes is the cumulative effect of a desire to produce a particular colour of egg held by a particular line of cuckoos for countless generation.

Reptiles.

Snakes of Deolali.—Papers on reptiles include a paper on the Snakes of Deolali by Mr. A. G. Fraser, I.M.D. Mr. Fraser is to be congratulated on the very intensive study he has made of the snakes of his district. His paper is a model to students engaged in field research. The author's objective is not only to provide a list of the snakes in his area but to study the various factors affecting the lives of snakes within the environment. His whole approach to the study is original and his notes on the osteological

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characters of snakes collected by him are particularly interesting and open up a fresh field for investigation.

The nesting of the King Cobra.—Messrs. H. C. Smith and F. J. Mustill's notes on the nest and eggs of the King Cobra is perhaps the first detailed description of the nest of this snake. It was generally known that the eggs of a hamadryad are laid in a heap of leaves, but the observations of the two writers indicate that the nest is more than a mere accumulation of leaves. It is a compact cup-like mass whose structure suggests a deliberate effort at nest building. Another interesting point revealed is that the snake does not sit directly upon the eggs but on a layer of leaves with which it covers the eggs. What we have still to discover is how the King Cobra builds this structure.

Fishes.

The Fishes of Travancore form the subject of a paper by Dr. C. C. John. The author provides a systematic list of the fishes of Travancore based on collections made in 1932-1933. He discusses method of capture, the factors injurious to the development of Fisheries in the State and recommends the introduction of Legislative measures to control existing methods of trapping and netting which have tended considerably to decrease the available supply.

Messrs. G. E. Shaw and E. O. Shebbeare describe a new species of fish of the genus *Glyptothorax* obtained in the Darjeeling District which they have named *G. horae* in honour of Dr. Hora of the Indian Museum.

Insects and Invertebrates.

The wasps of the genus *Ischnogaster,* remarkable for their unique nests are believed to form a link between the Solitary and Social Wasps because of their structural characters and their nesting habits. The larger species are as a rule solitary, their nests are built by a single pair. The smaller species live in a many-celled 'social' nest constructed by the community. Mr. T. R. Bell proposes a revision of the genus, wherein species of social habit are retained in the genus *Ischnogaster* and a new genus *Paravespa* is created for the solitary species, based on the distinctive structure of the mandibles in these wasps and in their peculiar nesting habits. Under the new genus *Paravespa,* Bell includes the species *eximia* from Ceylon and a new species *P. eva,* which is described by him. It is the only representative of the genus found in India proper. *Ischnogaster* is thereby now limited in its range to the Eastern Himalayas, Assam and the Indo-Chinese and Malayan countries.

Dragonflies.—Lt.-Col. F. C. Fraser describes two new species of Oriental Dragonflies: *Prothorthemis intermedia* and *Idionyx laidlawi.*

Caddis-Flies.—Part iv of Martin Mosely's monograph on Indian Trichoptera was published during the year. Further publication of this important work was suspended owing to reconsideration of

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the question of meeting the heavy cost of illustrations for these articles. The Society has made an application for a grant to meet this cost. Failing such financial assistance, the only alternative would be to extend the number of parts so as to spread the cost of illustrating the serial over a number of years. Mr. Mosely's work will probably remain for many years the standard work on Indian Trichoptera and it would be a pity to detract from the value to students of this most excellent work by curtailment of the plates and diagrams now being issued.

Butterflies.—Mr. D. F. Sanders' paper on the Butterflies of Secunderabad supplements the list of species recorded from this area by Col. Logan Home in volume xxxvii, No. 4 of the Society's *Journal.*

Lace Bugs.—A new species of Tingitid *Monanthia cheriani* is described by C. J. Drake from material collected by Mr. M. C. Cherian in Coimbatore.

South Indian Coccidae.—Dr. T. V. Ramakrishna Ayyar supplements his previous papers on South Indian Coccids, as a result of subsequent collections made by him. His new list contains 6 new species described by Green elsewhere and 7 species recorded for the first time from South India.

Botany.

Revd. Father Caius continues his papers on Medicinal and Poisonous Plants of India. Papers published by him during the year dealt with Medicinal and Poisonous Grasses, Orchids and Aroids of this country.

Flowering of Strobilanthes.—Very little is known about the periodical flowering of numerous species of *Strobilanthes.* Mr. P. V. Mayuranathan supplements Mrs. Robinson's useful contribution on the subject published in volume xxxviii of the *Journal* with a few further records. The planting community and others can do much to help in establishing the periodicity of the flowering in these plants by recording the time when the different species come into flower. Specimens in flower can be sent either to the Society or to Mr. P. V. Mayuranathan of the Government Museum, Madras for identification.

Beautiful Indian Trees.—With the publication of the article on the Padauk in the December issue of the *Journal,* the serial on Beautiful Indian Trees was completed. Thirty flowering trees of India have been described and illustrated in colour as well as in black and white. The thanks of the Society are due to the authors, the late Rev. Father Blatter and Mr. W. S. Millard, whose articles have given attraction to the *Journal.* They have now provided a popular and well-illustrated work on the trees which add so much to the beauty of our roads and gardens. This serial will be issued in book form about the middle of this year. By printing an extra number of plates when the articles were issued in the *Journal,* the Society has been able to keep the cost of the book at a remarkably low figure. The published price is Rs. 15 and Members may obtain copies from the Society at Rs. 10. Orders are now being registered.

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Shooting and Fishing.—The *Journals* issued during the year contained a number of articles on shooting and fishing. Among them is the interesting account by Mr. R. C. Morris of his quest for a specimen of the Lesser One-horned Rhinoceros in the jungles of Perak for the American Museum of Natural History. The failure of the expedition helps to emphasise the fact that, as in Burma, the species is practically extinct in the jungles of Malaya, where it was once reported to be common.

Mr J. E. Hall gives an account of hunting Wild Buffalo in the jungles of the Kosi River. Sportsmen of small means (which in these days implies the average shikari)—but blest with abundant energy—will be interested in Mr. Hall's account of a shooting trip in the C. P. which was written to show how much can be accomplished with hard work and the minimum of expenditure.

Mr. W. S. Thom gives an account of the Malay Tapir from his store of reminiscences covering many years of hunting in the jungles of Burma.

Contributors to the Journal.—The Committee take this opportunity of thanking all those who have contributed articles or notes to the *Journal*. The *Journal* is a vital link between the Society and its members and this can only be strengthened by adding to the interest and attraction of the publication. In writing for the *Journal* members help not only in furthering the work of the Society but in sustaining and increasing its membership.

Donations.—Donations amounting to Rs. 9,945-15 were received during the year from :

H. H. The Maharaja of Travancore
H. H. The Maharaja of Bhavanagar
H. H. The Nawab of Junagadh
H. H. The Maharawal of Dungarpur
The Chief Saheb of Miraj, Jr.
Mr. F. V. Evans.

The donations have been credited to the Journal Fund to cover extra expenditure on the *Journal*. The Committee take the opportunity of expressing the sincere thanks of the Society to all those who have so generously contributed to this Fund.

The Museum.

The rearrangement of the Natural History Section in the New Wing was taken up during the year. The new galleries have been designed especially to provide for the requirements of a modern Natural History Museum. Each gallery has its complement of large diorama groups built in a series of alcoves—while the systematic collections are arranged in cases along the walls of the gallery. The whole arrangement is pleasing and attractive and avoids the heaviness and artificiality which comes from overcrowding the floors with show cases and the cases with exhibits. Suitable colour schemes have been adopted in each gallery to secure harmony between the cases, their backgrounds and the walls. A feature of the New Museum is the 13 large diorama groups,

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8 of which were completed during the year. In the Bird Gallery three groups illustrate:—A nesting colony of Flamingos in the Rann of Cutch, the Griffon Vulture nesting on the cliffs near Bombay, and a Lämmergeyer's eyrie in the Simla Hills. Each group is a faithful reproduction of the nesting site based on photos, paintings and material collected on the spot. In the groups in the Mammal Gallery our objective has been not only to show some of the larger wild animals of the country in their natural habitat but also to give the visitor an idea of the varying nature of the country. Bison are shown in the shola-covered hills of South India, Blackbuck in the plains of Deccan, Tiger in the evergreen forests of Assam, Spotted Deer in the deciduous jungles of the C.P. and the Kashmir Stag in a Himalayan Forest. In the Reptile and Fish Gallery there is a submarine group of sharks and groups illustrating Loggerhead Turtles coming ashore to lay and a Malay Python in the setting of a Malay Jungle. A 20′ cast of this snake was made during the year and a perfect model produced. The Evans' collection of Marine and Fresh Water Fishes consisting of casts prepared from material collected in Bombay and other parts of India is shown in the gallery: and we take this opportunity of expressing our thanks to Mr. F. V. Evans who bore the entire cost of preparing these exhibits. A feature of the Fish Section is the fine murals which adorn the walls of the gallery. They are the work of Mr. A. Valleé whose services we were fortunate to secure. Our acknowldgment and thanks are also due to Col. Gharpurey who contributed Rs. 5,000 towards the cost of preparing and exhibiting the collection of reptiles. Among the snakes shown is a beautiful cast of the King Cobra, prepared from a live specimen presented by the Mysore Government.

Another phase of the work done during the year was the collecting of animals for mounting in these groups and also of various accessories for reproduction in them. Permission was obtained from the Madras Government for securing a female bison and calf to be set up with the fine male now exhibited. The specimens were obtained for the Museum by Mr. R. C. Morris to whom our thanks are due.

In March 1936, with the assistance of Mr. S. A. Vahid, I.F.S., Divisional Forest Officer, Khandwa, C.P., skins and the entire skeletons of a male and female Sambar were obtained. In the same month, the Maharaja of Bhavnagar kindly presented a set of male, female and young of the Blackbuck. While the Heir Apparent of Bikaner provided similar material for a group of Chinkara. Our thanks are also due to the Kashmir Durbar for presenting the entire skin and skeletons of a pair of Kashmir Stag which were obtained for us by the Game Warden.

The labelling of the exhibits in the entire Museum is being carried out in cellophane and glass. The method has proved quite successful. The labels are attractive and overcome the need for constant replacement which was an obvious disadvantage with paper labels which soon fade and are subject to mottling and discolouration.

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It will be seen from the above report that the year was one of great activity calling for an exceptional effort on the part of the staff to which they responded with their usual enthusiasm.

Revenue Account.

This account shows a small deficit of Rs. 835-10-5 which can be regarded as distinctly satisfactory as compared with figures for the previous three years:—

Year.	Deficit.
1933	Rs. 2,451 8 9
1934	,, 4,847 8 9
1935	,, 5,655 12 0
1936	,, 835 10 5

Actual receipts during 1936 amounted to Rs. 30,230-15-3 as compared with Rs. 26,847-7-11 in 1935. Subscriptions showed an increase of Rs. 1,597-0-10. The balance being made up by sales of Society's publications, a small profit of Rs. 239-0-8 on the Taxidermy Department and Rs. 706-14-6 due by members for outside work undertaken by the Society.

Expenditure shows a decrease of Rs. 1,486-10-3. This was effected by a drastic reduction in the cost of producing the Journals.

Salaries.

It will be noticed that the salary bill in 1936 amounted to Rs. 18,225-12-0 as compared with Rs. 16,188-8-3 in 1935. In 1935 the services of Mr. McCann and two others were loaned to the Chindwin Expedition for about three months, during which time their salaries were paid by the expedition.

Membership.

During the year 1936, 58 new members and 2 Life Members joined the Society and 67 members resigned. One has to expect these resignations as senior officers, Civil Servants and others retire and every effort is made to retain their interests after they leave India. The Society offers to send the *Journal* to retired members, postage paid, for an annual subscription of one guinea.

The total number of members on the roll of the Society (excluding 192 Life Members) was as follows:—

31st December 1935.....973
31st December 1936.....964

General.

A satisfactory feature of 1936 was the response to the appeal for donations to the funds of the Society. The total sum collected was Rs. 13,769-3-0 which amount has been placed to the credit of the Special Journal Fund which now stands at Rs. 11,089-8-6 as compared with Rs. 3,823-4-0 at the end of the previous year.

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Staff.

The Committee wish to record their appreciation of the good work done by the Curator and his staff during the past year.

P. M. D. SANDERSON,
Honorary Secretary.

Snake Venom.

A cinema film showing methods of extracting Snake venom at the Haffkine Institute, was shown by Lt.-Col. S. S. Sokhey, I.M.S.

Lt.-Col. Sokhey, speaking on the subject of snake venoms, described how perfectly they were adapted to their biological function of immobilising living and active prey and its subsequent digestion when swallowed whole. This end was achieved by the extraordinarily potent and very varied toxic properties of the venoms. These may be described as (*a*) action on the peripheral nervous system, producing muscular paralysis leading to death from failure of muscles of breathing, (*b*) direct action on the circulatory system, producing death from failure of heart, (*c*) action of the blood itself leading to clotting of blood in the vessels or to an entirely opposite action. There is also destruction of red blood cells, (*d*) action on the walls of the blood vessels leading to extensive bleeding in the tissues and (*e*) digestive action on the tissue due to ferments in the venom.

All these properties are not equally well developed in the venom of all snakes. Some of these toxic properties are more highly developed in the venom of some snakes, while others in the venom of other snakes. Of the Indian poisonous snakes the toxic action on the nervous system is most highly developed in the case of the Cobra, while the action on the circulatory system is most marked in the venom of the Russell's Viper. He then described the train of symptoms which result in human beings after a snake bites.

Next he took up the question of medicinal uses of venoms. Cobra venom has proved to be of some value in relieving pain in inoperable cancer. The hope that this venom would inhibit the growth of cancer has not been fulfilled. The venom of Russell's Viper is a very powerful agent in stopping intractable bleeding. It has proved of great value in stopping bleeding in cases of haemophilia and in case of operations on tonsils and teeth extraction. Scientific investigation has not supported the claim that snake venom is of any value in the treatment of epilepsy.

The Children of the Jungle.

Mr. S. Jepson showed his film depicting the life and customs of Bhils, Gonds and other jungle tribes.

In a few introductory remarks Mr. Jepson explained that the film was a self-imposed holiday task shot in a fortnight in the jungle, though it took much longer to prepare and to edit afterwards. There were many amusing moments with these original

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actors and actresses—including the selection of a bride for the wedding ceremony. The film was a documentary one, half dealing with the lives of Bhils and other forest tribes showing how they could be independent of cultivation, etc. The other half dealt with very amusing Bhil wedding customs. On returning to Bombay and after editing, the film had a running commentary superimposed on the sound track, in a local studio.

'As you will presently observe for yourself,' said Mr. Jepson humorously, 'I know nothing whatever about film making, and the whole thing was in the nature of an experiment.'

PRINTED AND PUBLISHED BY V. M. PHILIP AT THE DIOCESAN PRESS, 18, CHURCH ROAD, VEPERY, MADRAS, FOR THE BOMBAY NATURAL HISTORY SOCIETY, BOMBAY

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BOMBAY NATURAL HISTORY SOCIETY.

BALANCE SHEET AS AT 31st DECEMBER 1936.

LIABILITIES	Rs A P	Rs A P	ASSETS	Rs A P	Rs A P
Life Membership fees :		49,875 0 0	*Investments—At holding value or Market value on 31st December, 1936, whichever is lower :—*		
Donations for specific objects unexpended :			Rs. 35,000 3½% Loan 1947/50 at 102¼ % ...	35,787 8 0	
Show Cases, Models of Fish, etc. in Prince of Wales Museum—Account No. 1 ...	1,362 4 7		,, 15,000 5% do 1945-55 at par ...	15,000 0 0	
Show Cases, etc. in New Building, in Prince of Wales Museum—No. 2. ...	3,821 1 11		,, 10,000 3% do. 1951-54 at 98% ...	9,800 0 0	
Special Journal Fund	11,089 8 6	16,272 15 0	,, 14,000 4% Port Trust Bonds at 77%...	10,780 0 0	
			,, 15,000 4 % Improvement Trust Bonds at 76%...	11,400 0 0	
Sundry Creditors :			Rs. 89,000		82,767 8 0
Printers of Journals	2,292 10 8		*Cash—*		
,, of Beautiful Indian Trees ...	27 5 4		With National Bank of India, Ltd., Bombay	7,105 11 5	
,, of Bale Sons and Danielsson Ltd., London, Account ...			With National Bank of India, Ltd., London, £60-2-10 at 1/6	801 14 3	
,, of Game Book, Vol. I and II ...	27 10 8		On hand	150 0 0	
For Expenses	250 0 0	2,597 10 8			8,057 9 8
			Sundry Debtors :		2,029 11 0
Surplus Assets :			*Advances to Staff :*		373 0 0
Balance as per last Balance Sheet ...	31,541 13 2		*Furniture :*		
	Rs A P		As per last Balance Sheet	1,602 0 0	
Less.—Libel Case... ...	2,259 12 1		*Less* Depreciation	25 0 0	
Loss on Revenue Account.	835 10 5				1,577 0 0
	3,095 6 6		*Publications, excluding Journals :* Stock on hand as certified by the Hon. Secretary		300 0 0
		28,446 6 8	*Game Books, Vol. III :* Stock on hand as certified by the Hon. Secretary		536 12 1
			Beautiful Indian Trees : Stock on hand as certified by the Hon. Secretary		1,550 7 7
Total ...		97,192 0 4	Total ...		97,192 0 4

Note.—A stock of 20,100 old Journals and the valuable research collection and Library of 2,600 volumes have not been taken into account on the asset side of the Balance Sheet.

We have prepared the above Balance Sheet from the Cash Book and from the information given to us, and have verified the Investments.

In our opinion such Balance Sheet represents a true and correct view of the state of the Society's affairs according to the best of our information and the explanations given to us.

BOMBAY, *15th February, 1937.*

(Sd.) A. F. FERGUSON & CO.,
Chartered Accountants, Auditors.

H. M. McGUSTY,
Honorary Treasurer.

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BOMBAY NATURAL HISTORY SOCIETY.

REVENUE ACCOUNT FOR THE YEAR ENDED 31st DECEMBER, 1936.

Dr. *Cr.*

	Rs A P	Rs A P		Rs A P	Rs A P
To Salaries	18,225 12 0		By Subscriptions	22,006 7 8	
,, Society's Contribution to Staff Provident Fund	1,468 8 8		,, Entrance Fees	580 0 0	
,, General charges	294 11 4		,, *Sales of :*		
,, Rent	2,436 0 0		Journals	1,209 5 5	
,, Stationery and Printing	241 7 6		Game Books, Vols. I & II	847 0 11	
,, Postage	753 3 0		Bird Charts and Albums	472 9 9	
,, Library	338 4 10		Butterfly Books	126 7 2	
,, Audit Fee	250 0 0		Society's Small Publications	623 5 2	
,, Fire Insurance	100 0 0		,, Interest on Investments	3,419 12 0	
,, Depreciation on Furniture	25 0 0		,, Taxidermy Department	239 0 8	
,, Loss on Capt. Bate's '*Bird Life*' ...	478 8 6		,, Recoverable Charges	706 14 6	
,, Cost of Printing Journals	6,455 1 10				30,230 15 3
		31,066 9 8	,, Balance of Expenditure over Income ...		835 10 5
Total ...		31,066 9 8	Total ...		31,066 9 8

PUBLICATION ACCOUNT FOR THE YEAR ENDED 31st DECEMBER, 1936.

	Rs A P	Rs A P		Rs A P	Rs A P
To Stock of Game Books, Vol. III	705 9 0		By Sales of Game Book, Vol. III	212 0 0	
,, Expenses during the year	43 3 1		,, Stock on hand (31st December, 1936) ...	536 12 1	
		748 12 1			748 12 1
,, Stock of Beautiful Indian Trees ...	1,514 6 3				
,, Expenses during the year	36 1 4		,, Beautiful Indian Trees Stock on hand (31st December, 1936)	.....	1,550 7 7
		1,550 7 7			

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Dr. **Cr.**

INCOME AND EXPENDITURE ACCOUNT OF DONATIONS FOR SPECIFIC PURPOSES FOR THE YEAR ENDED 31st DECEMBER, 1936.

	Rs A P	Rs A P		Rs A P	Rs A P
Fund No. 1					
To Expenditure on Fish Gallery etc. ...	2,250 11 3		By Unexpended Balance as per last Balance Sheet	1,412 15 10	
,, Balance carried to Balance Sheet ...	1,362 4 7		,, Donations for the Modeller's Salary etc.	2,200 0 0	
		3,612 15 10			3,612 15 10
Show Cases Fund No. 2					
			,, Unexpended Balance for Show Cases in New Building as per last Balance Sheet	18,932 11 0	
,, Expenditure on Show Cases in New Building	20,143 10 1		,, Interest	532 1 0	
,, Balance carried to Balance Sheet ...	3,821 1 11		,, Donations during the year	4,500 0 0	
		23,964 12 0			23,964 12 0
Special Journal Fund					
,, Expenditure on Printing Plates, Journal, etc.	2,679 10 6		,, Unexpended balance as per last Balance Sheet	3,823 4 0	
,, Balance carried to Balance Sheet ...	11,089 8 6		,, Donations received during the year ...	9,945 15 0	
		13,769 3 0			13,769 3 0

BOMBAY, *15th February, 1937.*

Examined and found correct.
(Sd.) A. F. FERGUSON & CO.
Chartered Accountants, Auditors.

(Sd.) H. M. McGUSTY,
Honorary Treasurer.

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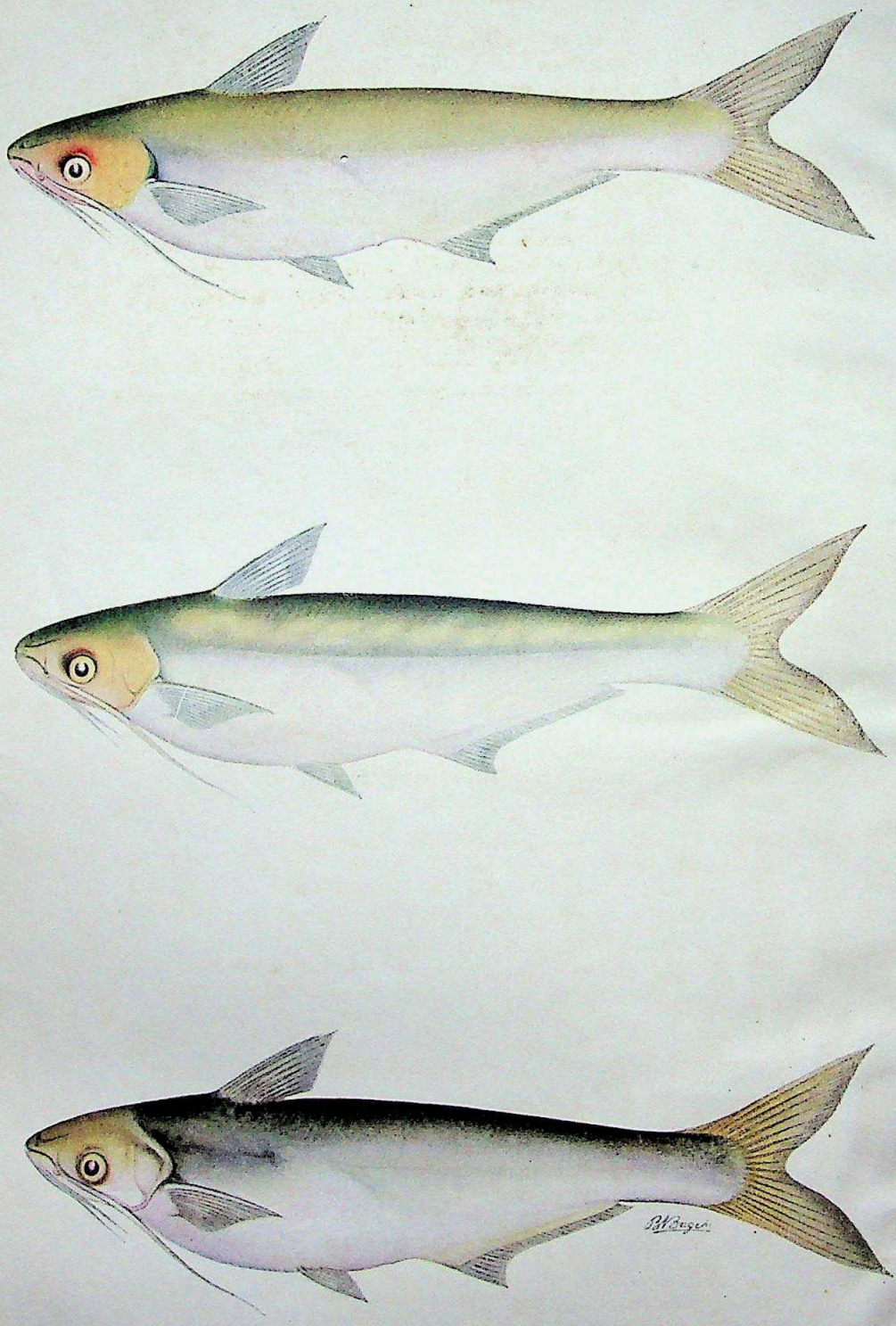

THE GARUA BĀCHCHĀ OR GAURCHCHĀ.

Clupisoma garua (Hamilton).

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JOURNAL
OF THE
Bombay Natural History Society.

DECEMBER 1937. VOL. XXXIX. NO. 4

THE GAME FISHES OF INDIA[1].

BY

SUNDER LAL HORA, D.SC., F.R.S.E., F.L.S., F.Z.S., F.R.A.S.B., F.N.I.,

Assistant Superintendent, Zoological Survey of India, Calcutta.

(With one plate and nine text-figures).

Continued from page 446 *of* Vol. xxxix.

III.—'GARUA BĀCHCHĀ OR GAURCHCHĀ'.

CLUPISOMA GARUA (HAMILTON) and two allied species.

CONTENTS.

	PAGE
Introduction	659
Nomenclature and Systematic Position	661
Synonymy and Description	666
Bionomics, and Fishing Notes	670
Description of two new species	671
Acknowledgments	677
List of References	677
Explanation of Plate	678

INTRODUCTION.

In the last article (21)[2] reference was made to the fact that among anglers two Indian catfishes go by the name of *Bāchchā*—*Eutropiichthys vacha* (Ham.) and *Clupisoma garua* (Ham.). Both the forms belong to the family *Schilbeidae* and are superficially

[1] Published with permission of the Director, Zoological Survey of India.
[2] Numerals in thick type within brackets refer to the serial numbers of the various publications listed in the bibliography at the end of the paper.

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very much alike. In my treatment of the true *Bāchchā*, I gave the distinguishing features of the two species and a reference was made to their habits and habitats. In the present article it is proposed to give a full scientific account of *Garua Bāchchā* or *Gaurchchā* and of its allied forms.

In the case of *E. vacha* it was shown that specimens of the species from Siam and Burma differed from Indian examples in proportions, etc., to a marked degree, but for want of sufficient material it was not possible to separate them into a distinct species. Similar differences have been observed in the case of the Burmese examples of *Clupisoma garua* (Ham.) and besides it has been found that in the specimens from Burma the entire abdominal edge is sharp and keeled. It has, therefore, been considered advisable to separate them into a new species which is described below (*vide infra* p. 671). To create a new genus on the nature of the abdominal edge would have rather confused the true relationships of the two forms. In this connection attention may be directed to the fact that in the species of *Rohtee* Sykes two similar types of abdominal edges are found (14), and it is remarkable that *R. belangeri* (Cuv. & Val.), in which the abdominal edge is keeled throughout, is essentially a Burmese species. Further it may also be noted that a species of *Pangasius* from Siam, *P. cultratus* Smith, is provided with 'a fleshy keel on the belly, extending from below the pectorals to the vent'. Fowler (11) has established a new genus *Pteropangasius* for its reception on this character alone. In all the three instances noted above it is remarkable that the forms with the keeled abdomen are found towards the east whence, according to my belief, the aquatic fauna migrated and spread towards the west (19). Further the keeled condition of the abdomen is probably a primitive feature, in so far as it is characteristic of the majority of the Isospondylous fishes and of the primitive Cyprinoids (subfamily: Abramidinae).

In the Eastern Himalayas, Messrs. G. E. Shaw and E. O. Shebbeare found another species in which the abdominal edge is rounded throughout, the barbels are considerably shorter, the air-bladder is greatly reduced, and there are certain differences in proportions from *C. garua* and the form found in Burma. Here again, though according to some authorities it may be desirable to separate it into a new genus I have considered it advisable for the time being, in view of the paucity of the material and of our very limited knowledge of these forms, to retain it in the genus *Clupisoma* and to describe it as a new species (*vide infra*, p. 673). Thus the three species here included in *Clupisoma* represent three very distinct types and in my opinion form an evolutionary series in which the Burmese form is probably the most primitive and the Eastern Himalayan form the most highly specialised in certain respects, and primitive in certain other respects.

As the colouration undergoes rapid changes when a fish is taken out of water, it is usually difficult to form a correct idea of the natural colours of large fishes; the so-called coloured drawings of such species can at best represent the colours of fresh

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specimens. My drawings of the 'Indian Trout' (*Barilius bola* Ham. 20) and of *Vacha* [*Eutropiichthys vacha* (Ham.) **21**] are no exception in this respect. In the drawings of *Garua Bāchchā* reproduced here an attempt has been made to show the changes in colouration undergone by the fish when taken out of water. The topmost drawing represents the colouration of the specimen immediately after its removal from water, the middle figure shows the fish after it had been out of water for about one hour and the bottom figure shows the colour after about two hours of the removal of the fish from the water. Gradually a uniform neutral tint begins to predominate and the colour becomes similar to that shown in my drawing of *Eutropiichthys vacha* (**21**). For all practical purposes, anglers are concerned with the colouration of the fresh specimens and not of the living fish and from this point of view the illustrations already reproduced or to be reproduced in connection with the articles to follow will be found useful. Efforts will, however, be made to describe the colouration of living specimens wherever possible. It may further be indicated that colour is liable to change with the surroundings, so in the case of fishes, at any rate, it does not form a reliable character for distinguishing species.

Nomenclature and Systematic Position.

The *Garua Bāchchā* or *Gaurchchā* was discovered for science by Hamilton (**13**), who named it *Silurus garua*. His interpretation of the genus *Silurus* Linn. seems to have been very vague, as, according to the modern standards, none of his species of *Silurus* is now referred to that genus. In Indian waters there are only two species of *Silurus* (**17**), *S. wynaadensis* Day and *S. cochinchinensis* Cuv. & Val. The following table shows the present-day systematic position of Hamilton's species of *Silurus*:—

Genus *Heteropneustes* Müller (**16**).

1. *Silurus singio* Hamilton [=*Heteropneustes fossilis* (Bl.)].

Genus *Callichrous* Hamilton (**18**).

2. *Silurus pabda* Hamilton [=*Callichrous bimaculatus* (Bl.)].
3. *Silurus canio* Hamilton [=*Callichrous bimaculatus* (Bl.)].
4. *Silurus duda* Hamilton [=*Callichrous bimaculatus* (Bl.)].
5. *Silurus chechra* Hamilton [=*Callichrous bimaculatus* (Bl.)].
6. *Silurus pabo* Hamilton (*Callichrous pabo* Ham.).

Genus *Wallago* Bleeker (**15**).

7. *Silurus boalis* Hamilton. [=*Wallago attu* (Bl.)].

Genus *Clupisoma* Swainson (**22**).

8. *Silurus garua* Hamilton. [*Clupisoma garua* (Ham.)].

In the first seven species, the dorsal fin is not provided with a bony, pungent spine and in this respect they agree with the typical members of the genus *Silurus*. In Hamilton's *S. garua* the first ray of the back fin 'is a prickle, indented behind, and terminated by a substance like whale bone' (**13**, p. 187). On this character, among others, *Gaurchchā* is to be regarded a member of the same family, *Schilbeidae*, as the true *vacha* described in the earlier article (**21**).

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Swainson (22) was the first to separate *Garua* from Hamilton's other allied species and constitute for it a separate genus *Clupisoma* which he defined as follows:—

'Herring-shaped; head and body compressed, of nearly equal breadth; eyes very large; teeth in both jaws and on the palate granulated and crowded; caudal fin large, forked; dorsal fin placed almost above the pectoral; vent nearly central.'

Swainson had no specimen of the species for examination but based his diagnosis of *Clupisoma* on Hamilton's description and figures of *Silurus garua*. At the same time, he proposed a new specific name—*argentata*—for this species. Cuvier and Valenciennes (6), Bleeker (1) and Blyth (4), however, assigned Hamilton's species to *Schilbe* Cuvier, an African genus closely allied to the Indian representatives of the family *Schilbeidae*. In the African genera of the family, however, the two pairs of mandibular barbels are situated at different levels, while in the Indian fishes they are placed in a single row. In 1858, Bleeker (2) separated the Indian species generically from the allied African forms and placed Hamilton's *Silurus garua* into a new genus, *Schilbeichthys*, which was briefly characterised as follows:—

'Pinna dorsalis hymenophora sinifera. Cirri 8. Dentes vomero-palatini in thurmus 4 dispositi.'

At the time of creating this genus Bleeker seems to have been aware of Swainson's *Clupisoma*, for he included *C. argentata* Swainson under the synonymy of his *Schilbeichthys garua*. Later, Bleeker (3) recognised Swainson's genus and merged his *Schilbeichthys* into its synonymy. The genus was included in the family *Siluriformes* and defined as:

'Dentes vomero-palatini in vittam quadripartitam dispositi. Nares magnae patulae approximatae, anteriores non tubulatae. Maxilla inferior superiore brevior. B.7. D.1/7. P. 1/11. V.1/5.'

Evidently not being aware of *Clupisoma* Swainson, Günther (12) adopted the generic name *Schilbeichthys* and emended its definition as follows:

'One short dorsal fin with a pungent spine; no adipose fin; the anal fin terminates at some distance from the caudal, which is forked. Barbels eight, as in *Ailia*. Vomerine and palatine teeth present. Nostrils close together, at the end of the snout, very wide, the posterior twice as wide as the anterior. Head covered with skin. The upper profile is nearly straight; neck not elevated; upper jaw longer than the lower; orbit with a broad anterior and posterior adipose eyelid, behind the cleft of the mouth. Ventral composed of six rays.'

Only one species—*Sch. garua*—was included by Günther in this genus.

Day (7) disagreed with all previous workers and assigned Hamilton's *garua* to *Pseudeutropius* Bleeker. In doing so he remarked:

'This species forms the type of the genus *Schilbeichthys*, Bleeker, which differs from the *Pseudeutropius* chiefly in having no second or adipose dorsal fin.

'I have taken a large number of the young of this species from 4 to 9 inches in length, and find that the adipose dorsal, though small, is distinct in the fry; but as the size of the specimens increases up to 6 or 7 inches it has either almost or entirely disappeared, and is invariably absent in the adult.

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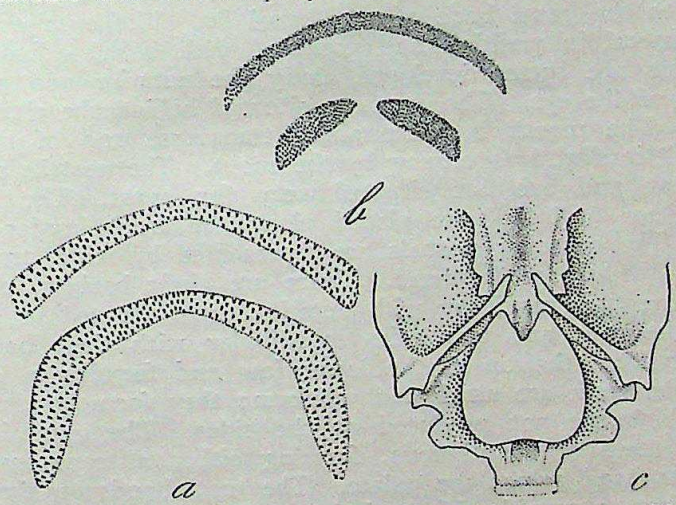
'I therefore consider the species to be a *Pseudeutropius;* for the difference which exists in the nostrils between it and some others of the genus is insufficient for more than a specific division.'

The above case for the inclusion of Hamilton's *Silurus garua* in *Pseudeutropius* is not based on any sound reasoning as will be shown in a subsequent communication elsewhere. It is, however, true that the adipose fin is present in the fry of *garua* and is gradually absorbed as the fish grows older. In his original diagnosis of *Schilbeichthys* (*vide supra,* p. 662), Bleeker referred to dentition as the most important character for the definition of his genus, but later he took into consideration the character of the nostrils also. These features, coupled with the herring-like form of the fish and the peculiar form and structure of the air-bladder, are sufficiently distinctive to separate Hamilton's *garua* generically from the allied forms included by Day under *Pseudeutropius* Bleeker. It may here be mentioned that Day's *Pseudeutropius* is a composite genus.

In *Clupisoma garua,* as a rule, the vomero-palatine teeth form a broad, semilunar band (text-fig. 1*a*) which may sometimes be interrupted in the middle. There is a specimen in the Indian Museum from Assam (No. 468; text-fig. 1*b*) in which the dentition is abnormal; the vomero-palatine bands are interrupted in the middle and lie obliquely across the palate. The palatine



Text-fig. 1.—Upper dentition and air-bladder of *Clupisoma garua* (Ham.).

a. Normal dentition of a specimen, 246 mm. in length without caudal. $\times 2\frac{2}{3}$; *b.* Abnormal dentition of the specimen No. 468, 126 mm. in length without caudal. $\times 4\frac{3}{5}$; *c.* Air-bladder of a young specimen, 95 mm. in length without caudal. $\times 3\frac{3}{8}$.

teeth are not produced backwards to form a semilunar band, as is usually the case in this species.

The structure of the air-bladder was at first described by Day (8) who stated that:

'Air-vessel in *P. garua,* H. B., small and somewhat heart-shaped, it is closely attached to the bodies of the anterior vertebrae; its external fibrous

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covering is of moderate length . . . *P. garua*, in which the adipose dorsal is so small, and altogether absorbed in the adult, has the smallest air-vessel amongst the larger species which I have examined.'

Bridge and Haddon (5) have, however, described the structure in much greater detail and I have figured it here (text-fig. 1c) to show its form in a young specimen 95 mm. in length without the caudal. With growth the bladder becomes more solid and is still further reduced, but its form remains more or less the same.

In the other two species similar variations of the tooth-bands and of the air-bladder are found. These are discussed below under the accounts of the new species.

From the above it is clear that the chief diagnostic features of the genus *Clupisoma* are (i) the form of the body, (ii) the nature of the tooth-bands, (iii) the form and nature of the air-bladder and (iv) the large size of the posterior nostrils. The genus may now be redefined as follows:—

The body is elongated and compressed; it is almost herring-shaped. The whole of the abdominal edge or the part between the pelvic fins and the vent may be keeled. The head and body are covered with soft skin. The head is oval, blunt and of moderate size. A median fontanel on head extends between the eyes to the nostrils. The occipital process is narrow and long; it extends almost to the basal bone of the dorsal fin. The eyes are large, ventro-lateral in position and provided with broad adipose lids; these lids are better developed along the anterior and posterior borders of the eye. The eyes are situated behind the cleft of the mouth. The mouth is subterminal, transverse and of moderate width; it is slightly overhung by the snout. The nostrils are very prominent and are not situated very far apart. The anterior nostrils are oval and are placed along the front border of the snout. The posterior nostrils are represented by wide, transverse slits on the top of the head. There are eight barbels, one pair nasal, one pair maxillary with anterior ends situated in grooves below the eyes and two pairs mandibular with their bases not very far from the tip of the lower jaw and forming a straight line. The teeth are small and villiform; they form bands in the jaws which are not produced at the sides. The vomerine and palatine teeth are contiguous, forming either a transverse or a semilunar band across the palate. The tooth-bands on the palate are subject to considerable variations. The dorsal fin is situated considerably in advance of the ventrals; it is provided with a spine of moderate strength which is finely serrated or roughened internally. A small adipose dorsal may be present or absent. The pectoral spine may be strong, roughened externally and serrated internally, or it may be soft and finely pectinated internally. The pelvics have six rays each. The anal fin is long. The caudal fin is deeply forked. The gill-openings are wide. The gill-membranes are deeply notched; they are united with each other but are free from the isthmus. The air-bladder is greatly reduced, thick-walled and flattened; it is closely applied to the ventral surface of the anterior vertebrae.

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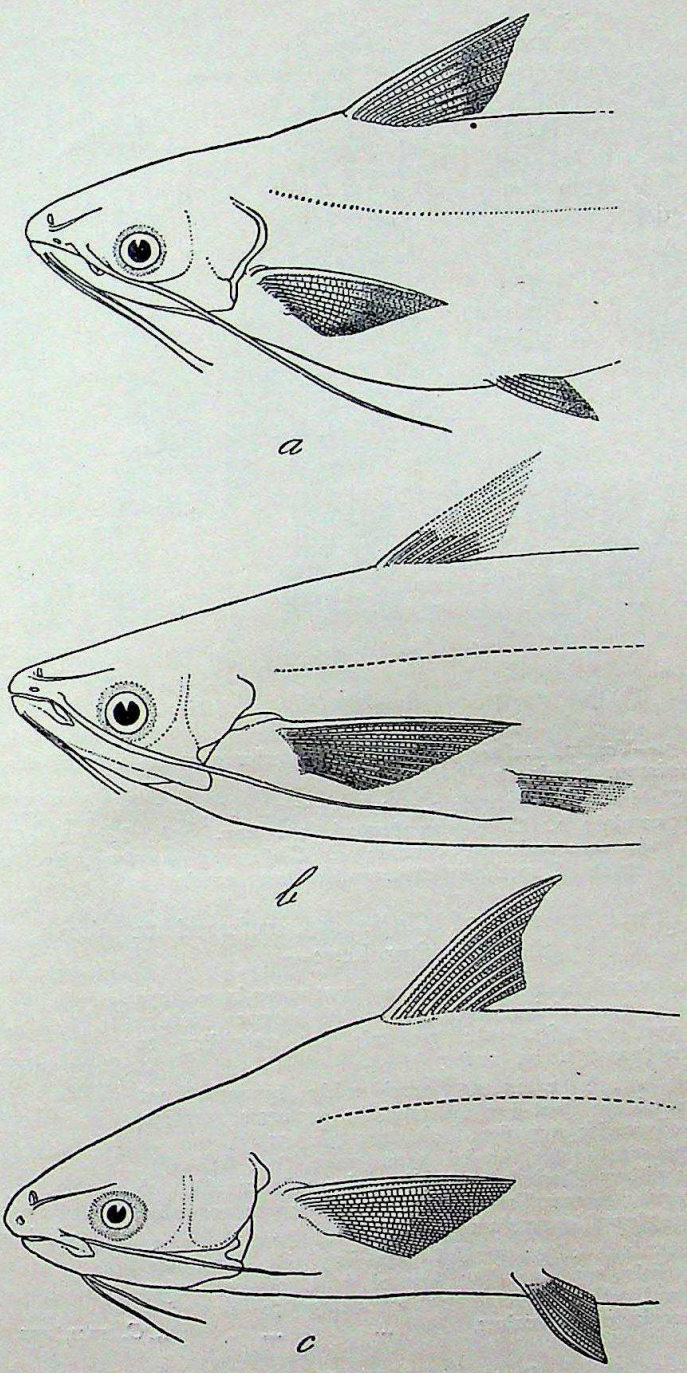

Text-fig. 2.—Lateral view of head and anterior part of body of the three species of *Clupisoma* Swainson.

a. *Clupisoma garua* (Ham.). ×⅔. Length of specimen 212 mm. without caudal; *b*. *Clupisoma prateri*, sp. nov. ×⅔. Length of specimen 240 mm. without caudal; *c*. *Clupisoma montana*, sp. nov. ×⅔. Length of specimen 241 mm. without caudal.

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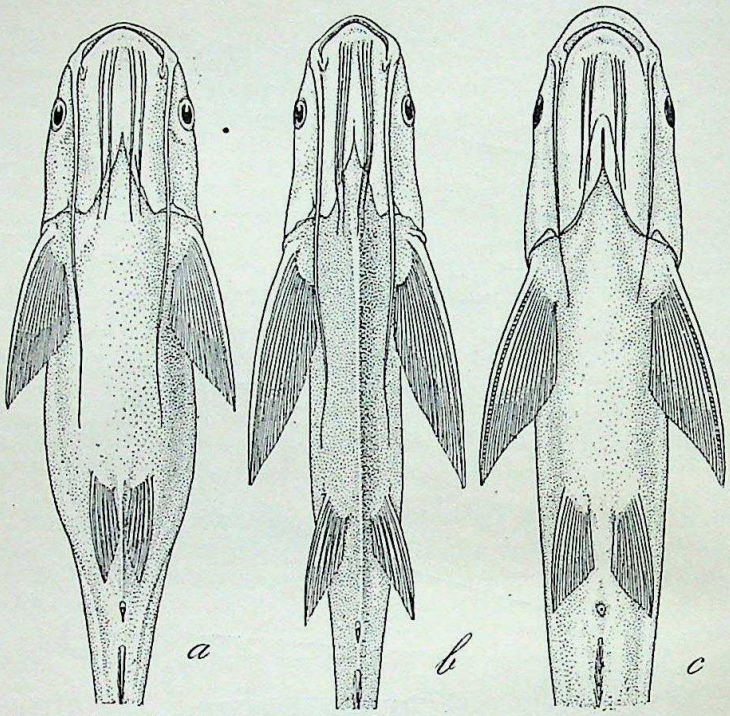

Text-fig. 3.—Ventral surface of head and anterior part of body of three species of *Clupisoma* Swainson.

a. *Clupisoma garua* (Ham.). ×⅔. Length of specimen 212 mm. without caudal; *b*. *Clupisoma prateri*, sp. nov. ×⅔. Length of specimen 240 mm. without caudal; *c*. *Clupisoma montana*, sp. nov. ×⅔. Length of specimen 241 mm. without caudal.

The three species of *Clupisoma*, referred to above, may be distinguished by the following key:—

A. Nasal barbels not extending to front margin of eye (text-fig. 2*a*); abdominal edge keeled between pelvics and vent (text-fig. 3*a*); pectorals not extending to pelvics (text-figs. 2*a* and 3*a*) ... ... *C. garua* (Ham.).

B. Nasal barbels extending considerably beyond front border of eye (text-figs. 2*b* and *c*); pectorals reaching base of pelvics (text-figs. 2*b*, 2*c*; 3*b*, 3*c*).

I. Abdominal edge keeled throughout (text-fig. 3*b*); maxillary barbels extending beyond middle of pectorals; mandibular barbels extending to posterior margin of operculum ... ... *C. prateri*, sp. nov.

II. Abdominal edge rounded (text-fig. 3*c*); maxillary barbels not extending beyond base of pectorals; mandibular barbels not extending to posterior margin of operculum ... ...*C. montana*, sp. nov.

Synonymy and Description.

Clupisoma garua (Hamilton).

1822. *Silurus garua*, Hamilton, *Fish. Ganges*, pp. 156, 375, pl. xxi, fig. 50.
1839. *Clupisoma argentata*, Swainson, *Nat. Hist. Fish.* etc., ii, p. 306.
1839. *Schilbe garua*, Cuvier & Valenciennes, *Hist. Nat. Poiss.*, xiv, p. 379, pl. ccccxiii.

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1853. *Schilbe garua*, Bleeker, *Verh. Bat. Gen.*, xxv, pp. 54, 110.
1858. *Schilbe garua*, Blyth, *Proc. As. Soc. Bengal*, p. 283.
1858. *Schilbeichthys garua*, Bleeker, *Ichth. Arch. Ind. Prod.*, i, Siluri, p. 256.
1862. *Clupisoma garua*, Bleeker, *Versl. Akad. Amsterdam*, xiv, p. 393.
1863. *Clupisoma garua*, Bleeker, *Ned. Tijdschr. Dierk.*, i, p. 114.
1864. *Schilbeichthys garua*, Günther, *Cat. Fish. Brit. Mus.*, v, p. 57.
1869. *Pseudeutropius garua*, Day, *Proc. Zool. Soc. London*, p. 307.
1871. *Pseudeutropius garua*, Day, *Proc. Zool. Soc. London*, p. 709 (Air-bladder).
1873. *Pseudeutropius garua*, Day, *Rep. Freshw. Fish. Fisheries India & Burma*, p. 265.
1877. *Schilbeichthys garua*, Beavan, *Freshw. Fish. India*, p. 134.
1877. *Pseudeutropius garua*, Day (in part), *Fish. India*, p. 474, pl. cix, fig. 6.
1889. *Pseudeutropius garua*, Day (in part), *Faun. Brit. India Fish.*, i, p. 141.
1894. *Schilbeichthys garua*, Bridge & Haddon, *Phil. Trans. Roy. Soc. London* (B), clxxxiv, pp. 211-213 (Air-bladder and Weberian Ossicles).
1913. *Pseudeutropius garua*, Chaudhuri, *Rec. Ind. Mus.*, viii, p. 255.
1937. *Clupisoma garua*, Hora, *Proc. Nat. Inst. Sci. Ind.*, iii, p. 39 (disposition of liver and kidney).

Vernacular Names:—*Garua*, *Gharuya* and *Gaurchchā* (Calcutta, Lakshmipur and Goalpara); *Kocha* (Tista); *Punia Cathua* (Ooriah); *Puttosi* (Bengal); *Buchua* (Hind.); *Dhon-ga-nu* (Sind); *Buchua*, *Chel-lee* and *Ka-raad* (Punjab); *Bikree* (Oudh).

Clupisoma garua is a herring-shaped fish, tapering very gradually toward both ends. The head is oval, blunt, and of moderate size; it is somewhat wider than the body. The length of the head is contained from 4.8 to 5.6 times in the length without the caudal; its height at the occiput is almost equal to its greatest width and is contained from 1.2 to 1.6 times in its length. The head is proportionately longer and narrower in young specimens. The eyes are large, ventro-lateral in position and situated almost in the middle of the head. The longest axis of the pupil is vertical. The diameter of the eye is contained from 3 to 3.8 times in the length of the head; from 1.2 to 1.6 times in the length of the snout and from 1.1 to 1.8 times in the interorbital width. The head is provided with a median fontanel between the eyes which extends to the nostrils. The occipital process is long and pointed; it is nearly 4 times as long as wide and sometimes extends to the basal bone of the dorsal fin. There are four pairs of barbels; the nasal barbels usually do not extend as far as the anterior border of the eye, the maxillary barbels reach to the base of the pelvics, and the mandibular barbels to the base of the pectorals. In younger specimens the barbels are proportionately longer. The nostrils are very prominent; the posterior nostrils are large oval slits, sometimes three times as broad as the anterior nostrils. The mouth is fairly wide and almost anterior; the snout projects beyond the lower jaw only slightly. The teeth are small and villiform; those on the palate are arranged in a semicircle. Sometimes the vomero-palatine band is indistinctly divided into four patches and very rarely the teeth on the palate are arranged in two short bands disposed in a transverse row.

The dorsal fin is wholly in advance of the ventrals; its spine is rather slender, rugose anteriorly and feebly serrated posteriorly;

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it is almost as long as the head behind the nostrils. The adipose dorsal is always absent in the adult, but in young specimens up to about 100 mm. in length it is present as a minute structure. The pectoral spine is somewhat longer and stronger than that of the dorsal fin; it does not extend to the base of the pelvic fins; it is roughened externally but denticulated internally. The ventral fins are situated slightly dorsal to the ventral profile of the body. The abdominal edge between the pelvics and the vent is keeled. The caudal fin is deeply forked; the lower lobe is longer than the upper.

The depth of the body is contained from 4.6 to 5.6 times in the length without the caudal. The head is somewhat broader than the width of the body.

According to Hamilton (13), 'The prevailing colour is silver, with green on the back. The fins are diaphanous, that on the back and the pectorals being dotted and that of the tail being edged with black. The head and shoulders have a golden gloss.'

During the fishing of a large settling tank at the Calcutta Corporation's Water-works at Pulta during August 1937, several specimens of *Clupisoma garua* were obtained. As there was an artist with me, he very kindly noted the changes in colouration and the three illustrations in the colour plate show this point very clearly. When the fish is just taken out of water the dorsal surface is yellowish apple-green and the upper surface of the head is French-green. The side of the head is light orange-buff with a streak of coral red above the eyes. The sides of the body are silvery showing metallic hues. The fins are mostly diaphanous, but the caudal fin is light yellow in colour with a margin of light neutral tint. About an hour afterwards, the colour along the dorsal surface became French-green and the original yellow was still present in a broad, lateral patch one along each side. The side of the head changed to yellow ochre and the streak above the eye to madder-brown. The marking of the caudal fin became somewhat deeper. After about 2 hours the colour changed to a neutral tint and the caudal fin became distinctly yellow. The head developed light neutral tint and with a considerable proportion of the yellow colour. The base of the anal fin turned light lemon-yellow. The caudal fin became raw sienna and its margin turned still deeper. Finally the colour of the fish changed to a silvery neutral tint, just as was figured in the case of *Eutropiichthys vacha* (Ham.) in the second article of this series.

Distribution:—The material of *C. garua* in the collection of the Indian Museum is not sufficient to discuss its distribution. Day (10) stated that the fish is 'Found generally throughout the larger rivers of Sind, India, Assam and Burma'. The Burmese specimens represent a distinct species. It seems probable that the fish does not occur in the Deccan as I have not found any record of the species from that area. Though I recently collected a considerable amount of material from the Hooghly river above Calcutta, there are not many specimens from other localities in India for study. Consequently it is not possible to give an account of the probable variations undergone by the species.

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Measurements in millimetres.

	C. P.	Sara Ghat, Bengal	Saran, Bihar	Shantipur, Hooghli River.	Orissa	Shantipur, Hooghli River.	Assam	Calcutta, Hooghli River.	Kanchara-para, Hooghli River.
Total length excluding caudal ...	96·0	97·0	130·0	132·0	166·0	198·0	220·0	273·0	276·0
Length of head	20·0	20·0	25·3	25·0	33·5	35·0	43·0	51·0	53·0
Width of head	12·0	12·5	16·0	17·0	23·0	25·0	29·0	38·0	41·0
Height of head at occiput ...	12·0	12·5	16·0	18·0	23·0	27·0	33·0	38·0	42·0
Width of body	9·0	11·5	13·5	15·0	16·0	22·0	25·0	28·0	32·0
Height of body	18·5	18·0	25·0	25·0	33·0	40·0	47·0	48·0	59·0
Diameter of eye	6·0	6·5	8·0	8·0	10·0	11·0	13·0	16·0	14·0
Length of snout	7·0	8·0	10·0	10·5	13·0	15·0	16·0	20·0	21·0
Interorbital width	7·0	8·0	11·0	12·0	16·0	18·5	19·0	24·0	26·0
Length of pectoral spine ...	14·0	15·0	24·5	23·0	33·0	34·5	39·0	50·0	51·0
Length of dorsal spine	13·0	...	...	21·0	29·0	30·0	37·0	41·0	46·0
Length of nasal barbel	6·5	4·0	4·5	6·0	7·0	6·0	11·0	11·0	10·0
Length of maxillary barbel ...	33·0	46·0	55·5	55·0	69·0	68·0	77·0	107·0	96·0
Length of outer mandibular barbel.	17·0	15·0	23·0	20·0	30·0	25·0	39·0	43·0	38·0
Length of inner mandibular barbel.	19·0	19·0	24·0	24·0	26·0	28·5	42·0	44·0	45·0
Least height of caudal peduncle ...	8·0	8·0	11·0	13·0	16·0	16·0	19·0	24·0	27·5
Commencement of dorsal from tip of snout	30·0	31·0	39·0	40·0	55·0	60·0	67·0	82·0	85·0

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Bionomics and Fishing Notes.

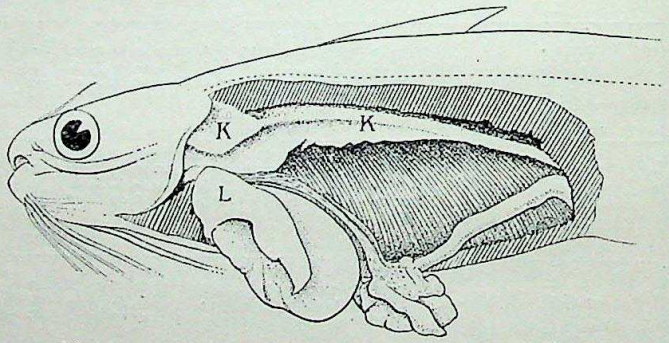
In his list of the fishes of the Rangpur District Hamilton (*vide* Day, 9) made the following observation under *Gharaya*:

'This is a very common fish, but is not eaten by the higher classes, because it is supposed to feed on excrement. It grows to three feet in length, and although its colours are green and silver, has a very lurid ugly appearance.'

In his (13) 'Gangetic Fishes', however, he states:

'The *Garua* is common in the fresh water rivers of the Gangetic provinces, often grows to two feet in length, and by the natives is considered as good eating. It has little or none of that lurid appearance to which many kindred fishes are liable.'

So far as my experience is concerned *Garua Bāchchā* is considered good eating throughout its range. In the Punjab *Bāchchā* is considered a great delicacy by the Indians and Europeans alike and fetches a somewhat higher price. In the course of my recent survey of the Hooghli river above Calcutta I found that both *Eutropiichthys vacha* and *Clupisoma garua* were sold everywhere at a somewhat higher price than the other species of fish.



Text-fig. 4.—Dissection of the visceral organs of *Clupisoma garua* (Ham.), to show the nature of the alimentary canal and the disposition of the liver (L) and the kidney (K). $\times 1\frac{1}{3}$. Reproduced from *Proc. Nat. Inst. Sci. India*, vol. iii, p. 39, 1937).

An examination of the stomach contents of a number of large specimens, over a foot in length, obtained from the Calcutta Corporation's Water-works at Pulta on the 14th August, 1937, showed that the fish feeds on crabs, shrimps, fish, insects, etc. A certain amount of vegetable matter was also found in the stomach of some specimens. The alimentary canal is one and a half times as long as the entire length of the fish and this clearly shows that, as compared with *Eutropiichthys vacha*, it is probably not a very clean feeder. The stomach is in the form of a large bag devoid of any ridges along its walls. As I remarked in the earlier article, probably *Clupisoma* feeds at the bottom whereas *Eutropiichthys* chases its prey in mid-water or at the surface. The nature of the mouth opening in the two forms lends considerable support to such a view.

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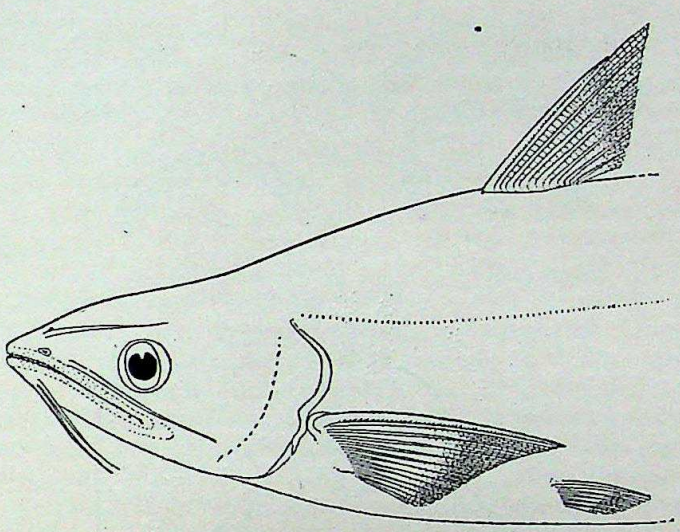
As anglers in writing their notes have hitherto made no distinction between *Eutropiichthys* and *Clupisoma* I have nothing further to add regarding the fishing of *Garua Bāchchā* beyond



Text-fig. 5.—Lateral view of head and anterior part of body of a specimen, 260 mm. long, of *Eutropiichthys vacha* (Ham.) from the river Hooghli. ×¾.

what has already been given in my earlier account (**21**). It should, however, now be possible for anglers to make notes on the two species separately for the benefit of sportsmen in general.

Description of two new Species.

Clupisoma prateri, sp. nov.

1877. *Pseudeutropius garua*, Day (in part), *Fish. India*, p. 474.
1885. *Pseudeutropius garua*, Vinciguerra (in part), *Ann. Mus. Civ. Stor. Nat. Genova* (2), ii, p. 91.
1889. *Pseudeutropius garua*, Day (in part), *Faun. Brit. Ind. Fish.*, i, p. 141.
1890. ? *Pseudeutropius garua*, Vinciguerra, *Ann. Mus. Civ. Stor. Nat. Genova* (2), ix, p. 209.

Day (**10**) appears to be the first writer who extended the range of *Clupisoma garua* (Ham.) to Burma without making any comments. Vinciguerra (**23**) examined one specimen from Burma (Bassein) and one from Calcutta in 1885 and referred both of them to Hamilton's species without noting any points of difference between the two. Later, in his (**24**) more comprehensive work on the fishes of Burma, he found that his single specimen from Mandalay agreed with his previous example from Bassein and both of them differed from the Calcutta example. He mainly referred to the differences in the length of barbels, pectoral spine, anal fin and in the dentition and was doubtfully of the opinion that the specimens from Burma may not belong to Hamilton's species.

In the old collection of the Indian Museum there are several specimens from Burma referred by Day to *Clupisoma garua*. A careful examination of this material and its comparison with the

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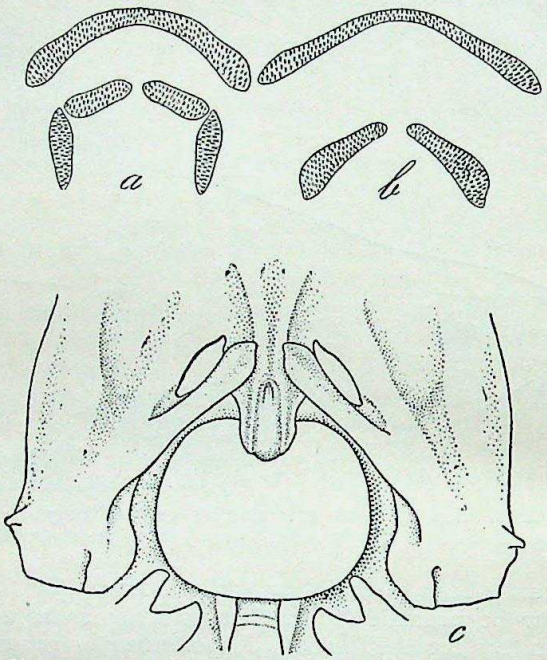
typical examples from various parts of India have shown that Vinciguerra's doubts were justified. Though the Burmese examples are not in a very good state of preservation, their main



Text-fig. 6.—Upper dentition and air-bladder of *Clupisoma prateri*. sp. nov. *a*. Upper dentition of specimen, No. 6048, 131 mm. in length without caudal. ×3⅓; *b*. Upper dentition of type-specimen, Dup. Cat. No. 219, 212 mm. in length without caudal. ×3⅓; *c*. Air-bladder and associated skeletal elements of the type-specimen. ×3⅓.

features are so distinct from the Indian species that I have no hesitation in proposing for them a new species—*Clupisoma prateri*, and to associate it with the name of Mr. S. H. Prater in slight recognition of the valuable help he has rendered to me from time to time in procuring fresh material of Indian fishes for my studies.

The species will be described in detail when fresh material from Burma becomes available, but for the present I give below in a tabular form the main points of difference between *Clupisoma garua* (Ham.) and *Clupisoma prateri*, sp. nov.

Clupisoma prateri, sp. nov.	*Clupisoma garua* (Ham.).
1. Nasal barbels extend considerably beyond front margin of eye; sometimes even to the posterior border of eye.	Nasal barbels do not reach the eye.
2. Maxillary barbels extend to about the middle of pelvics, and sometimes to the commencement of the anal fin.	Maxillary barbels extend to base of pelvics, or in young to middle of pelvics.
3. Mandibular barbels extend to the hind border of operculum.	Mandibular barbels extend to the base of pectorals.

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	Clupisoma prateri, sp. nov.	*Clupisoma garua* (Ham.).
4.	Pectorals extend considerably beyond the commencement of pelvics.	Pectorals do not extend to base of pelvics.
5.	Anal with about 40 to 44 rays.	Anal with about 32 rays.
6.	Whole of dorsal fin considerably in advance of the pelvics.	Whole of the dorsal fin just in advance of the pelvics.
7.	Abdominal edge keeled throughout in front of vent.	Abdominal edge keeled between bases of pelvics and vent.

Besides the differences enumerated above between the two species, the relative proportions of the various parts also differ and these can be made out by a reference to the tables of measurements.

In the young specimens there is a small adipose fin, but it becomes wholly absorbed during growth. The dentition is more or less similar to that described above for *Clupisoma garua* and a similar type of abnormality is found in some of the specimens. Reference may here be made to the fact that in the specimen examined by Vinciguerra the vomero-palatine bands are short and are of the same nature as those illustrated here in text-figure 6*b*.

Locality: Burma.

Type-specimen: Duplicate Catalogue No. 213, *Zoological Survey of India, Calcutta.*

Measurements in millimetres.

	No. 8765	No. 8709	Dup. Cat. No. 219.
Total length excluding caudal ...	87·0	133·0	231·0
Length of head...	17·0	25·0	38·0
Width of head	11·0	15·5	23·5
Height of head at occiput... ...	11·5	17·0	28·0
Width of body	7·0	12·0	18·0
Height of body...	15·0	24·5	45·0
Diameter of eye	5·5	7·5	12·5
Length of snout	6·0	10·0	14·0
Interorbital width	8·0	11·0	15·0
Length of pectoral spine	19·0	29·0	50·0
Length of dorsal spine	14·0	...	...
Length of nasal barbel	8·0	12·5	13·5
Length of maxillary barbel ...	38·0	58·5	87·0
Length of outer mandibular barbel ...	18·0	22·0	31·0
Length of inner mandibular barbel ...	19·0	24·0	32·0
Least height of caudal peduncle ...	6·5	11·0	20·0
Commencement of dorsal from tip of snout	27·0	38·0	64·0

Clupisoma montana, sp. nov.

D. 1/6-7; A.41-43; P.1/12; V.6; C.17.

Clupisoma montana is a graceful species in which the head and body are moderately compressed and the body is relatively less deep. The dorsal profile is slightly arched, being highest near the commencement of the rayed dorsal. The head is short and bluntly

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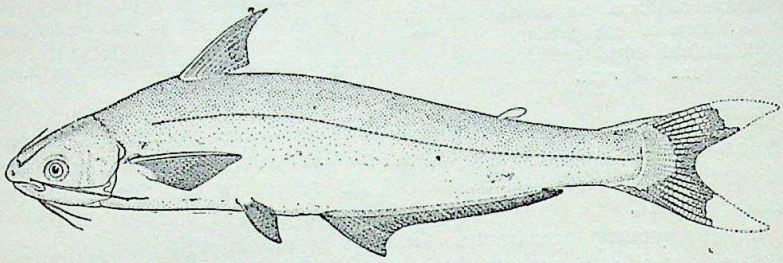
pointed; its length is contained 5 times in the total length without the caudal. The width of the head is contained from 1.5 to 1.6 times and the height at occiput from 1.2 to 1.3 times in its



Text-fig. 7.—Lateral view of type-specimen of *Clupisoma montana*, sp. nov. ×¼.

length. In the middle of the dorsal surface of the head there is a narrow groove which commences between the nostrils and the eye and extends over the occipital process. The occipital process is long and narrow and almost meets the basal bone of the dorsal fin. The eyes are situated almost in the middle of the length of the head and are placed laterally above the angle of the mouth; they are provided with broad circular lids. The diameter of the eye is contained about 4.8 times in the length of head, 1.8 times in length of the snout and 2 times in the interorbital width. The interorbital space is distinctly convex. The mouth is inferior and obliquely directed upwards. The lips are thin and adhere closely to the jaws, except at the angles of the mouth where they form free lobes by their union. The lower jaw is somewhat sharp and broadly pointed. The teeth are small and villiform; those of the jaws form narrow bands which may be interrupted in the middle; those on the palate form two oblong and somewhat curved patches which may be continuous. The teeth on the upper jaw are in advance of the lower jaw. The nostrils are situated wide apart; the anterior nostrils are rounded, slightly tubular and directed forwards; the posterior nostrils are considerably larger, more approximated and situated on the top of the head. There are eight barbels; one pair nasal, which extend beyond the anterior margin of the eye; one pair maxillary which are somewhat longer than the head and two pairs mandibulars which are close together at a short distance behind the tip of the lower jaw and are considerably shorter than the head. The maxillary barbels are situated in grooves which run below the eyes. The gill-openings are wide, but only the portion above the base of the pectoral fin is provided with a broad membrane and it seems probable that this portion is mostly used during respiration, as has been observed in the case of other hill-stream fishes.

The rayed dorsal is situated above the pectorals and is almost entirely in advance of the ventrals. Its spine and the anterior branched rays are considerably longer than the posterior ones. The dorsal spine is rather feeble, smooth anteriorly and finely serrated posteriorly. The adipose fin is small, but distinctly

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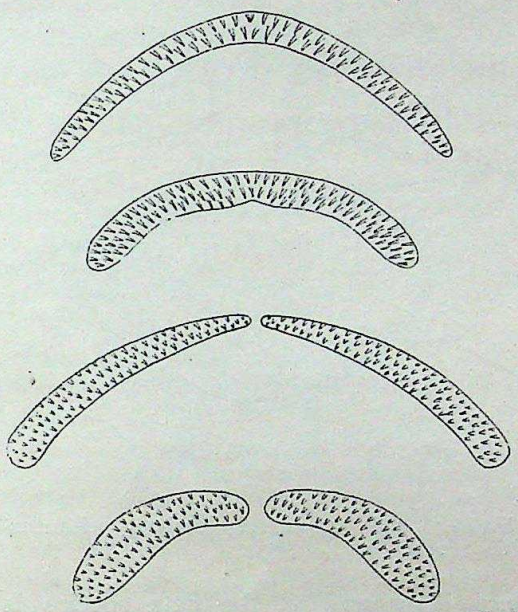
marked; it is situated about the beginning of the last third of the distance between the commencement of the rayed dorsal and the base of the caudal fin. The anal fin is long with about half-a-dozen



Text-fig. 8.—Upper dentition of two specimens of *Clupisoma montana*, sp. nov. ×4.

anterior rays somewhat longer than the others; its base is about one-third the length without the caudal and terminates at a considerable distance from the caudal fin. The pectoral fin is long and pointed; its spine is somewhat stronger than that of the dorsal and is smooth externally and finely serrated internally; it extends beyond the commencement of the ventral. The ventrals just reach the anal opening. The caudal is deeply forked.

The depth of the body is contained from 4.5 to 4.8 times in the length without the caudal and the least height of the caudal peduncle 1.8 times in its length.

In the spirit specimens the head is dull white while the back is gray which fades on the sides. The lower portion is olivaceous. The eyes are grayish in colour.

The air-bladder is transversely ovate and greatly flattened; its anterior portion is almost solid and the posterior part is bent in the form of a semicircular canal suggesting an approach to the structure found in *Eutropiichthys* and *Ailia*. Owing to the paucity of specimens I have not been able to investigate this structure more fully.

Locality: Teesta River, below Darjeeling.

Type-specimen: F 12472/1, *Zoological Survey of India, Indian Museum, Calcutta.*

Remarks: *Clupisoma montana* can be readily distinguished from *C. garua* by the (i), relative shortness of its barbels (ii), relative

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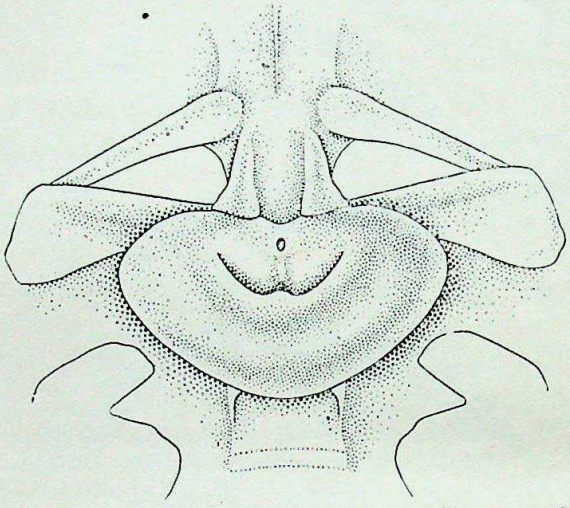
weakness of its dorsal and pectoral spines (iii), presence of adipose dorsal in the adult (iv), upper dentition (v), larger number of rays in the anal fin and (vi), structure of the air-bladder.



Text-fig. 9.—Air-bladder and associated skeletal elements of *Clupisoma montana*, sp. nov. ×4.

In characters ii, v and vi the new species is more highly specialised whereas in the other three characters it is more primitive. It seems probable that the two species have evolved from a common generalised form, one taking to life in mountainous streams while other entered sluggish waters. The ecological differences in their habitats probably led to the production of two species. The generalised form is probably represented at the present day by *Clupisoma prateri*, sp. nov.

Measurements in millimetres.

Total length without caudal	237·0	241·0
Length of head	47·5	48·2
Depth of body	48·5	53·2
Width of head	36·0	30·0
Height of head at occiput	37·5	36·6
Length of snout	18·0	19·0
Diameter of eye	10·0	10·0
Interorbital width	20·0	20·0
Length of caudal peduncle	37·0	39·0
Least height of caudal peduncle	20·2	20·0
Longest ray of dorsal	39·0	45·0
Longest ray of anal	29·0	31·0
Length of pectoral	40·0	43·0
Length of ventral	26·0	25·0
Length of nasal barbel	17·0	14·0
Length of maxillary barbel	52·0	56·0
Length of outer mandibular barbel	26·0	22·0
Length of inner mandibular barbel	36·0	28·0
Length of base of anal fin.....	78·0	80·0

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The Bombay Natural History Society very kindly made a grant towards the cost of the illustrations and for this I offer my sincere thanks to the authorities of the Society. Mr. K. S. Misra, M.Sc., my assistant in the Zoological Survey of India, has helped me in the preparation of the tables of measurements and for this I am very grateful to him. The illustrations were prepared by Babu B. Bagchi with his usual skill and care under my supervision.

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Explanation of Plate.

Laterai view of a specimen of *Clupisoma garua* (Ham.) from the Settling Tanks of the Calcutta Corporation Water-works at Pulta. ×*ca.* ½.

The three illustrations show the changes in colouration which a specimen undergoes after its removal from water.

Top. Immediately after removal from water.
Middle. One hour after removal from water.
Bottom. Two hours after removal from water.

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THE BIRDS OF BOMBAY AND SALSETTE.

BY

SĀLIM ALI and HŪMĀYŪN ABDŪLALI.

PART III.

(With one plate).

(Continued from page 530 of this volume).

The Great Indian Reed Warbler : *Acrocephalus stentoreus brunnescens* (Jerdon).

Field identification : A large olive-brown Warbler noticeable for its vehement call, usually found in mangrove swamps or among reeds in marshes. When calling, the orange-red inside of the mouth is distinctive.

Specimens : *B.N.H.S.* : ♂ 2-4-30 Rewās (S.A.); *St. Xavier's College* : 22 14-8-33 ; 236 24-4-35 ; Gōrēgāon.

Noted at Mahūl, Trombay, Gōrēgāon, Gōdhbunder and Powāi Lake.

This typical warbler, though surprisingly local, is not uncommon in suitable localities. It is partial to mangrove swamps and our only records away from this habitat are from the reed-beds at Powāi.

The call or song is remarkably loud for the size of the bird. At times it is ventriloquistic in character seeming to come from a different direction to whence it really does. When moving about the bushes it utters a harsh *ke ke* something like that of a Babbler.

Though long believed to be only a winter visitor to our area, there can now be little doubt that some birds at least remain to breed in the thick mangrove swamps that fringe the numerous creeks along our coast. The specimen collected at Rewās on 2-4-30 had testes measuring 6×4 mm. (see note in *J.B.N.H.S.*, xxxv, p. 450) and their presence in these parts during every month of the year may be regarded as further evidence.

That no nests have yet been actually obtained in our area is partly due to the extremely difficult country the birds inhabit. There is for instance, one two-mile patch of mangrove (*Avicennia officinalis*), *Ceriops Candolleana*, and the spiny-leaved sea-holly (*Acanthus ilicifolius*) and mud, intersected by tidal creeks, where half a dozen localised pairs may invariably to seen during July and August. Thus located it may seem an easy matter to find their nests, since the males persist in warbling vociferously from prominent positions. The mangrove and the sea-holly have, however, so far prevented our making a closer acquaintance with nesting birds.

The song is well described by Whistler as 'very loud and variable, hard and metallic for the most part, but also interspersed with pleasant bars. But the essential burden of the refrain, constantly recurring, is the loud *karra karra kareet kareet kareet* or *prit prit pritik* which suddenly bursts out of a reed-bed with astonishing vehemence'. When warbling, the throat swells out revealing a patch of dark feather-bases.

Blyth's Reed Warbler : *Acrocephalus dumetorum* Blyth.

Field identification : A smaller replica of the Great Reed Warbler found in bushes etc. both near and away from water. In the season when it is with us it is seldom heard warbling.

Specimens : *B.N.H.S.* : ♂ 22-1-11 Kheneri Island (C.A. Crump); o? 28-11-26 ; 17-11-27 Chembūr ; 27-11-27 Tūlsi Lake (S.A.); *St. Xavier's College* : 30 o? 17-11-32 Powāi Lake (H.A.).

Blyth's Reed Warblers along with other migratory warblers are common on passage in late autumn and in spring, and many individuals also spend the winter with us. But the paucity of specimens and the difficulty of distinguishing these birds in the field do not allow many notes.

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This Warbler is, however, one of the commonest and may be met with singly, hopping about in bushes, uttering an incessant *chuck - chuck*. It is less of a marsh bird than the last species. Its song—sometimes heard just before the birds leave for their breeding grounds in mid-March—is a pretty subdued chittering warble. The last date on which we have noted it, across the harbour, is 9th May which is of course exceptionally late.

The Paddy-field Warbler : *Acrocephalus agricolus* Jerdon.

Field identification : A small warbler with rufous rump found usually in tall grass, reeds or standing paddy.

Specimens : *B.N.H.S.* : o 2-12-28 Gōdhbunder (S.A.). Also noted at Kihim (Alibag District).

Winter visitor. The Paddyfield Warbler is not common in Salsette, but one or two may sometimes be put up from in amongst the patches of tall grass in semi-marshy ground bordering the Gōdhbunder creek. This, in fact, is the only locality in our area where we have come across it. It has the habit, when flushed, of skimming over the tops of the grass in a jerky flight and spreading its tail as it dives into the stems every few yards. The rufous tinge on the rump is then conspicuous.

The Tailor-Bird : *Orthotomus sutorius guzerata* (Latham).

Local name : *Dirzee, Phitki.*

Field identification : A tiny bird about $\frac{2}{3}$ the size of a Sparrow. Olive green above with a rusty crown and elongated middle feathers in the tail. Frequents gardens and shrubberies in town and suburbs.

Specimens : *B.N.H.S.* : Several from Vihār, Pāli Hill and elsewhere in the suburbs. *St. Xavier's College* : 49 ♂ 18-8-33 Bandra (H.A.).

Noted : *Bombay City and suburbs* : Khētwādi, Girgaum, Bhūleshwar, Chowpāti, Fort, Government House Grounds, Wālkeshwar, Warden Road, Malabār Hill, etc., Pāli Hill, Andhēri, Khār, Chembūr, Borivli and elsewhere. *Mainland* : Common everywhere in suitable localities.

Resident. A familiar little bird usually seen in pairs, frequenting gardens and shrubbery everywhere in the city as well as suburbs. They frequently enter verandahs and show little fear of man. Usually hopping about amongst potted plants and small bushes uttering a loud, cheerful *to - wit, to - wit, to - wit, to - whee, to - whee,* etc. While this is being uttered the head is raised and a black crescent-shaped mark is visible on either side of the swelled-out throat. They are partial to *Bombax* and *Erythrina* flowers, and in season may be seen regularly feeding on the nectar.

Breeding : The nesting season begins in May and lasts till October. During the monsoon not only is insect life plentiful for rearing the young, but a great many large-leaved plants spring up, such as various species of *Leea,* affording the requisite nesting sites to this and allied warblers.

The nest is placed in a funnel formed by folding over and stitching a broad leaf along its edges. Sometimes 2 or more leaves are sewn together. The stitching material is usually cotton or vegetable down which is cleverly knotted at the ends to prevent the sewing getting undone. It is said that the hen alone does the sewing, but this we have not ascertained. Within the funnel the usual type of cup-shaped nest is fitted, composed of soft fibres and cotton wool or vegetable down. It is usually within 2 or 3 feet of the ground. The lowest nest we have seen was in the leaf of a teak seedling, partly trailing the ground; the highest about 8 feet up in a *Terminalia catappa* or 'country almond' tree. Croton, fig and other plants growing in pots in a garden, porch or verandah are much favoured.

In our area a clutch of 3 eggs, or occasionally 4, seems to be the normal. We have taken both the unmarked pale blue and the red-spotted eggs here.

The Streaked Fantail Warbler : *Cisticola juncidis cursitans* (Franklin).

Field identification : Size about the same as the last. A small fulvous brown bird with black centres to the feathers of the back giving it a streaked appearance; under parts whitish; the rufous rump and white eyebrow are rather conspicuous. The white-tipped tail and the wandering, mounting flight accompanied by *chip, chip, chip,* as of garden shears is diagnostic. Usually frequents areas covered with tall grass and weeds.

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Nest and Eggs of the Streaked Fantail Warbler (*C. j. cursitans*) at Church Gate Reclamation.

Nest of *Cisticola j. cursitans* at Church Gate Reclamation.

Photos by : *Br. Novarro, S. J.*

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Specimens: *St. Xavier's College* 4-7-35 Churchgate, Bombay (Back Bay Reclamation).

Noted: Gōdhbunder, Villé Pārlé, Andhēri, Bhāndūp, Kūrla, Rewās, Bassein. Resident, but shifting locally with the availability of suitable habitats. The Streaked Fantail Warbler is a recent colonist on the unappropriated reclamation area, between Churchgate and Colaba. It is quite common in the grass and rank vegetation that springs up here during the monsoon. Single birds may usually be seen up in the air, indulging in their undulating wandering flights, uttering *chip, chip, chip*. This is the first indication of the presence of the species in any locality.

Breeding: On 30 June Brother Navarro S. J. took a nest on the Churchgate Reclamation containing a clutch of 4 eggs. On 4 July 5 nests were discovered in the same area, 4 in the course of construction and 1 containing 1 fresh egg. These nests were all destroyed by grass-cutters soon after. On 30 September 2 more nests with c/5 each were located, and a third nearing completion. All the nests were built into the upright stalks of the green smooth grass (species?) which grows in tussocks on this area. They were all witihn 6 inches of the ground and practically invisible at a few feet distance.

The large number of Calotes lizards and rats inhabiting this area must cause much destruction of eggs and young.

Franklin's Wren-Warbler: *Franklinia gracilis gracilis* (Franklin).

Field identification: A tiny warbler with longish, seemingly loosely attached tail. Dusky greyish-brown above, light coloured underneath with a broad pale ashy band across the breast. Usually seen in small flocks of 3 to 5 in scrub jungle with tall grass, or in mango groves and deciduous forest with rank undergrowth.

Specimens: *St. Xavier's College*: ♀ 19-8-33 Gōrēgāon 247 o? 10-12-35. Andhēri (H.A.).

Except for one record on 22-4-34 we have only come across this bird in Salsette during the monsoon from July to about December. In the breeding season males make themselves conspicuous by warbling from exposed situations such as the top of a bush or tree. The song consists of a musical or tinkling *chiwee - chiwee - chiwee, chip - chip - chip - chip* commencing low and feebly, the *chips* rising in scale and ending abruptly. Its status in our area is uncertain. It may prove to be a local migrant, but on the other hand it may conceivably have escaped notice in the non-breeding plumage which is a sober brown above and rather similar to that of the Indian Wren Warbler. The breast band is almost absent.

Breeding: This warbler breeds in Salsette and on the adjacent mainland during thte monsoon. We have the following records of nests:—

6 September (1934) Tānsa Lake with c/4 fresh.
17 September (1933) Sāki village (near Andhēri) with c/4 fresh.
10 October (1933) under construction.

The nest is similar to that of the Tailor-bird but usually somewhat more globular in shape. It is built in the broad leaves of some monsoon plant like *Leea*. The eggs in the above nests were white in one case, light blue in the other, both unspotted. Frequently they are spotted and blotched with reddish-brown.

The Rufous-fronted Warbler: *Franklinia buchanani* (Blyth).

Field identification: Size same as last. In appearance very similar to *gracilis* in the brown winter plumage, but with a rusty crown as in the Tailor-bird and a distinctive white tip to the tail. No breast band.

No specimens.

This is apparently a rare straggler into our area. S.A. has only come across it on a single occasion at Chembūr (7-6-32). Its usual habitat is drier country than that frequented by *gracilis*.

The Booted Tree-Warbler: *Hippolais rama scita* (Eversmann).

Field identification: Smaller and lither than Sparrow. Fulvous brown above, sandy-buff underneath. In general appearance very similar to Blyth's Reed Warbler, but lacking the olive tinge in the upper plumage. Frequents bushes and shrubbery.

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Specimens: *St. Xavier's College*: 156 o Jūhū 31-10-33; 190 o, 191 4-4-34 Jūhū (H.A.) *B.N.H.S.* Coll.: 10-2-13 Santa Cruz (N. B. Kinnear), 3-3-29 Tūlsi Lake (*rama* or *scita?*) (S.A.).

Noted: Pāli Hill, Chembūr and throughout Salsette and commonly on the mainland.

This tree-warbler is a very common winter visitor to our area. Our earliest record is on 16 October; latest 4 April. In habits and appearance it is so similar to Blyth's Reed Warbler that the two are not infrequently confused in the field. It is very probable, moreover, that the typical race of this bird, *H. r. rama*—Sykes' Tree Warbler—also occurs within our area in winter. In the field these two races are almost impossible to tell one from the other which confounds the confusion further!

It goes about the bushes singly, searching systematically for insects and uttering *chuck, chuck* incessantly at intervals of a second or two.

The Eastern Orphean Warbler: *Sylvia hortensis jerdoni* (Blyth).

Field identification: Size slightly larger than Sparrow. Brownish slaty-grey above, whitish below with a conspicuous black cap. Tail black with some white in it. Frequents Babul and open scrub country.

Specimen: *St. Xavier's College*: 183 Jūhū 13-3-34 (H.A.).

Apparently only a rare and irregular passage migrant in spring. The stomach of our specimen contained 1 small snail, 4 seeds (sp ?) and some insect remains.

The Indian Lesser Whitethroat: *Sylvia curruca affinis* (Blyth).

Field identification: Size smaller than Sparrow—about the same as Blyth's Reed Warbler. Upper plumage earthy brown with the forehead and crown grey. Tail brown and white, chin and throat pure white, rest of underparts buffy or pale greyish white. Singly in scrub and thickets.

Specimens: *St. Xavier's College*: 162 2-11-33, 212 5-12-34 Andhēri (H.A.).

Noted: *Mainland*, Kihim; Bassein.

A passage migrant and winter visitor. Probably commoner than it appears to be but overlooked or confused with the numerous other warblers of the same size, appearance and habits that visit us at this season. The earliest date we have recorded is 7 October.

It frequents scrub-and-bush country and hunts for insects in the same way as the Booted Tree-Warbler uttering the same sort of *chuck, chuck* at intervals.

The Willow-Warblers are all tiny birds, mostly much smaller than the Sparrow, olive green or olive brown above, and varying shades of yellow underneath. They are some of our most numerous winter visitors. They flit about restlessly among the foliage of trees hunting tiny insects from the sprigs and flowers. They may often be seen clinging upside down on the sprigs or launching graceful little sallies after winged insects. While with us—in their winter quarters—they are seldom in song, but the call notes of the different species are as a rule sufficiently distinctive to furnish a clue to their identification in the field. Indeed when once authenticated, we have found the call notes to be in many cases the only means of identifying the different species more or less reliably. Wherever there are trees, these little birds will be found. We have found the following species in Bombay and Salsette, though probably several others occur besides:

Tickell's Willow-Warbler: *Phylloscopus affinis* (Tickell).

Specimen: *B.N.H.S.*: 7-3-26 Trombay Hill, Chembūr (S.A.).

Olivaceous Willow-Warbler: *Phylloscopus griseolus* Blyth.

Field identification: Easier than most members of this group that visit us. Earthy brown or greyish-brown above, yellow or buffy-yellow below with a distinctive yellow eyebrow. A brown streak through the eye. Very partial to rock-scarps, fort ruins, etc., which it clambers about, constantly flicking its wings and uttering a monosyllabic *pink*.

Specimen: *St. Xavier's College*: 185 ♂ Gōrēgāon 19-3-34 (H.A.).

This species seems to be uncommon in our area, the specimen being our only record for Salsette.

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The Green Willow-Warbler : *Phylloscopus nitidus nitidus*· Blyth.

Specimens : *B.N.H.S.* : 16-10-26 Kihim (S.A.) ; *St. Xavier's College* : 138 ♂ Kihim 20-10-33 (H.A.).

Tha Greenish Willow-Warbler : *Phylloscopus nitidus viridanus* Blyth.

Specimens : *B.N.H.S.* : ♀ 19-12-08 Santa Cruz, ♀ 4-12-09 Andhēri (N.B.K.) ; *St. Xavier's College* : 130 ♂ Kihim 18-10-33 (H.A.).

These two races, which are quite impossible to tell with certainty in the field, are our commonest willow-warblers in winter. We are unable to distinguish between their call notes which are a sharp perky *chi-wee* repeated at intervals of a few seconds as the birds hop about the foliage of trees in quest of insects.

The Ashy Wren-Warbler : *Prinia socialis socialis* Sykes.

Field identification : Smaller than Sparrow. Ashy grey above, fulvous white below with a loose longish graduated tail of rufous colour tipped whitish and with a dark subterminal band. The tail is usually held partly erect and shaken up and down. Frequents gardens and shrubbery—also scrub country.

Specimens : *B.N.H.S.* : 22-3-24 Gōdhbunder, 14-6-25 Trombay Hills, (S.A.), ♀ 7-3-10 Gōrēgāon (N.B.K.), *St. Xavier's College* : 171 ♀ Borivli 19-11-33, 24 ♂ Powāi Lake 16-7-33 (H.A.).

Noted : *City* : Malabār Hill, near Chowpāti Band Stand, Government House grounds—Wālkeshwar, Pherozeshah Mehta Gardens, Victoria Gardens, Warden and Pedder Roads, etc. ; *Salsette* : Khār, Bandra, Trombay Hills, Kandivlee and elsewhere.

Resident. The Ashy Wren-Warbler is a common and familiar bird in Bombay and Salsette. Like the Tailor-bird—but perhaps somewhat less urbanly —a pair or so is found in most gardens of any size where shrubs or bushy borders occur. We have occasionally also observed it amongst mangroves.

During the monsoon months, when the birds are breeding, the males thrust themselves into prominence. They constantly climb up to some exposed situation as the top of a bush whence they pour forth their warbling feverishly. The bird flits about, jerks its tail up and down and often flutters its wings. Its laboured and undulating flight conveys the impression that the tail is much too heavy for the owner to carry.

While it feeds in the main on insects and caterpillars it is also very partial to the nectar of Tree Cotton and Coral flowers, upon which it may usually be seen.

We have repeatedly marked this bird producing the crackling noise of an electric spark described for *P. inornata* by Whistler and for *P. flaviventris* in the *Fauna*. We are doubtful as to the origin of this, but H.A. thinks that it is not vocal (see Ticehurst and Stanford *J.B.N.H.S.*, xxxiv, p. 909).

Breeding : The breeding season is in the monsoon when weeds and rank vegetation spring up affording suitable nest sites. The principal months are July, August and September. We have records of many nests in Salsette during this period. Two types of nests are found (1) of the Tailor-bird type in sewn-up leaves (2) an oblong purse of woven fibres with supporting leaves or grass stems partially incorporated into the structure. In our area the former is by far the commoner. It is usually situated less than 2 feet from the ground. The eggs, usually 3 in number, are a more or less uniform light Indian red in colour with often a darker ring round the broad end. The texture is beautifully glazed.

The Indian Wren-Warbler : *Prinia inornata inornata* Sykes.

Field identification : Similar in size and habits to the Ashy Wren-Warbler but differing from it in being a dull earthy brown with a tinge of rufous especially pronounced on the rump. The principal difference lies however in the habitats of the two species. The present is more addicted to the neighbourhood of paddy fields and to rank grass land.

Specimens : *B.N.H.S.* : 21-3-24 Chembūr, 22-3-24, 21-12-28 Gōdhbunder (S.A.) *St. Xavier's College* : 54 ♀ 20-8-33 Sāki Village ; 144 ♂ 23-10-33 Kihim, 180 ♂ juv. 25-2-34 Panvēl (H.A.).

Resident. Common. The difference in the facies mainly occupied by this and the foregoing species has been indicated above, but sometimes the two are

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found in the same locality. We have never observed this Wren-Warbler within city limits proper.

Its call notes and warbling are markedly different and distinctive from those of the Ashy Wren-Warbler, but it is impossible to convey an adequate rendering on paper.

Breeding: The breeding season perhaps commences slightly later than in the foregoing—in August—and we have found eggs upto the end of October.

The nest is usually a woven oblong or pear-shaped purse of fibres with the entrance on one side near the top. It is slung hammockwise between upright grass stems and some of the adjacent blades are often cleverly bent and incorporated into the structure. It is seldom more than 18 in. or 2 ft. from the ground. A favourite site is the grass and weeds growing on bunds separating paddy fields. The eggs, usually 4 sometimes 5, are a pale blue in ground colour with reddish blotches forming a ring round the broad end and interconnected by fine pencillings of the same colour. The texture is smooth and glossy.

EHA in *N. & E.* (i, 303) records eggs on 22 and 28 August.

The Indian Oriole; *Oriolus oriolus kundoo* Sykes.

Field identification: Size about that of a Myna. A bright yellow bird with black in the wings and tail and a conspicuous black streak through the eye. The female is usually duller and greener. Inhabits groves of trees and wooded country, singly or in pairs.

Specimens: *St. Xavier's College*: 70 ♂ 18-9-33 Gōrēgāon (H.A.).

Noted: *City*: Khētwādi, Grant Road, Chowpāti, Byculla, Warden Road; *Salsette*: Pāli Hill, Chembūr, Vihār, Powāi and Tūlsi Lake environs, Borivli, Gōdhbunder and elsewhere; Elephanta Island. General on mainland.

The Indian Oriole is a common winter visitor to our area from about September to April. We have seen an isolated example each as late as 9 May and 7 June.

EHA (*B. of B.*, p. 95) says these birds leave us about the beginning of the hot season and go to drier climes inland to bring up their young, returning in September. This no doubt is correct.

Single birds or pairs may commonly be seen in gardens in the city as well as in the suburbs. It frequents well-wooded country, and large shady trees such as Banyan, Peepal, Mango and Tamarind are much patronised.

Their usual call notes are a harsh *cheeah* and a rich mellow whistle something like *Pe-lo-lo*. The food consists of Ficus figs, and berries of various kinds to which are added on occasion insects and the nectar of flowers such as *Bombax* and *Erythrina*.

Breeding: We cannot trace any record of its breeding on the mainland in our neighbourhood or in the Ghats.

The Black-headed Oriole: *Oriolus xanthornus maderaspatanus* Franklin.

Field identification: Size same as last. A brilliant golden yellow bird with jet black head, throat and upper breast. Black in wings and tail. Frequents groves and well-wooded country singly or in pairs.

Specimens: *St. Xavier's College*: o 23-7-33 Borivli, Salsette (H.A.).

Noted: *City*: Only Malabār Hill, Cumballa Hill, and Wālkeshwar. Common generally in the suburbs and Salsette.

Resident, but partly also local migrant. There is a marked increase and decrease in its numbers at the commencement and end of the cold weather.

In habits it does not differ appréciably from the Indian Oriole, though it seldom ventures into the low country. The harsh monosyllabic note commonly uttered is very like the first note of the Tree-Pie and may frequently be mistaken for it.

The adult male and female are alike in appearance and what is described as the female plumage in the *Fauna* (iii, 12) is merely that of the immature bird.

Breeding: We have found nests in Salsette, on Mount Poinsur and in the Tūlsi Lake environs, on 11 and 14 July. The latter contained 1 newly hatched young. The nest is a neat cradle of fibres, slung hammockwise in the horizontal fork of twigs near the extremity of an outhanging branch of Mango, *Bassia* or some other large tree. It is usually placed at a height of 20-30 feet from the ground. On 2 July (1933) an adult was observed chasing off a crow from the vicinity of a young bird lately out of nest, with unsteady flight and a stub tail. The normal clutch consists of 3 eggs.

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It has been repeatedly observed that Orioles, along with such other mild mannered birds as doves and babblers build in the same tree as holds a drongo's nest. Whether this be by accident or design, there is no dobut that the birds thereby enjoy a certain amount of protection against marauders like crows. The king-crow will placidly tolerate their neighbourhood but a crow has only to show himself near the nest tree to be set upon and beaten off by the valiant owners!

The Southern Grackle : *Gracula religiosa indica* (Cuvier).

Talking or Hill Myna.

Field identification : A glossy jet black bird, slightly larger than Myna, with yellow bill and legs and bright orange yellow patches of naked skin and wattles on the head. A favourite cage bird. Usually seen as such in the Crawford Market and with fanciers.

Straggler ? The only occasions on which we have come across this bird in our area are : (1) A solitary bird at Pāli Hill 1-4-24 and (2) A pair in a tall and leafless tree in the forest by the Tūlsi Lake on 29-3-31. The former may possibly have been an escaped cage bird.

About 1924 Mr. M. Suter of Bombay in a letter to the Society wrote : 'I have shot recently a specimen of the Southern Hill Myna (Grackle) which therefore seems to occur on Salsette Island'. Ordinarily this grackle is an inhabitant of the evergreen forest tracts of S.W. India and Ceylon.

The Rosy Pastor or **Rose-coloured Starling** : *Pastor roseus* (Linn.).

Local names : Raan Shalé (Mahratti), Hyya, Wyha, Jowari Bird.

Field identification : Size about that of Myna. Head and crest, throat and upper breast glossy metallic black. Wings and tail black. Rest a beautiful pale rose-pink. Noisy flocks seen principally on the leafless flowering Silk Cotton Tree.

Common in winter from about October to April but the arrival of the main body in our midst coincides more or less with the flowering of the Silk Cotton Tree (*Bombax malabaricum*) about mid-January, and their departure with the end of the flowering season, i.e. end of March or early April. When the *Bombax* is in flower Rosy Pastors are perhaps the most regular and numerous habitués to them and during the greater part of their sojourn here they seem to subsist almost entirely on the nectar. They are present wherever a *Bombax* tree is flowering, be it actually within town limits (such as Marine Lines, Elphinstone Circle Gardens, Cruikshank Road and elsewhere) or in the suburbs and less inhabited parts of Salsette. They seem to function as important cross-pollinating agents for this tree, collecting the pollen on their head feathers in their attempts to reach the nectar, and transferring it on to the mature stigma of the next flower. The flowers of the Coral Tree (*Erythrina indica*) are also patronised but to a lesser extent. Ficus figs and berries of various species are largely eaten. We have found *Lantana camara, Streblus asper* and *Salvadora persica* to be almost invariably present in the stomachs of birds examined in our locality.

During the time they are with us, thousands of birds collect every evening in the cocoanut palms at Jūhū to roost in company with Mynas.

The Rosy Pastor is a natural enemy of locusts and a useful check on their numbers. Its breeding grounds in Russian Turkestan coincide with those of the locusts, and it wreaks enormous destruction among the insects in every stage of their life history. In India the birds do a certain amount of damage to ripening Jowari crops, but on the other hand are a great help to the ryot during times of locust invasions when they destroy enormous numbers of locusts, many more than they actually eat.

The Grey-headed Myna : *Sturnia malabarica malabarica* (Gmelin).

Field identification : A small trim Myna. Common. Grey above with blackish wings. Throat and breast pale lilac-grey, rest of underparts rusty brown, darkest under tail. Small flocks in open secondary jungle and thinly wooded country.

Specimens : *B.N.H.S.* : ♂ ♀ 5-2-24 Pāli Hill; 19-9-26 Kandivlee (S.A.); ♂ ♀ 5-12-28 Bandra (E. Henricks); *St. Xavier's College* : 4 ♂ 9-2-33 Kihim (H.A.).

Noted : *City* : Warden Road, Nepean Sea Road, *Salsette* ; Chembūr, Trombay Hills, Borivli, and elsewhere.

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The Grey-headed Myna is a resident in small numbers in Salsette but it is largely a local migrant. There is a marked influx in its numbers in about September which lasts till the beginning of the hot weather.

The birds are usually met with in pairs or small flocks of 6-8, often in association with Common and Brahminy Mynas and Rosy Pastors. They are regular attendants on Silk Cotton and Coral flowers for the nectar. There is a great deal of squabbling and chasing about from branch to branch and from one flower cluster to another when a flock is on the scene. Lantana berries and figs of the Banyan and Peepal are also largely eaten.

Breeding: We have no record of its breeding in our area.

Blyth's Myna: *Sturnia malabarica blythii* (Jerdon).

Field identification: Differs from the last chiefly in having the whole head, neck and breast white instead of silvery grey.

Specimens: *St. Xavier's College*: 5 ♂ 23-7-33 Tūlsi Lake environs.

The discovery in our area of this race of the Grey-headed Myna is of great interest. It is the South Indian form of the bird and not recorded previously north of South Konkan. The specimen was solitary and apparently a straggler.

We have, however, from time to time observed individuals amongst flocks of Grey-headed Mynas which have looked suspiciously like this bird. It is possible that on further investigation it may prove to wander into our area less rarely than has been supposed.

The Black-headed or **Brahminy Myna**: *Temenuchus pagodarum* (Gmelin).

Field identification: Somewhat smaller than the Common Myna. Grey above, rich buff or reddish-fawn below, with black wings and blackish tail. Head and a long crest glossy black. The broad grey edging of the somewhat wedge-shaped tail is conspicuous when it is spread before the bird alights. Small flocks in secondary jungle and fairly wooded country, frequently in association with Grey-headed Mynas.

Specimens: *B.N.H.S.*: ♀ imm. 9-11-12 Santa Cruz (N. B. Kinnear); *St. Xavier's College*: 149 juv. Nov. 33 Kihim (H.A.).

Noted: *City*: Warden Road, *Salsette*: Pāli Hill, Khār, Andhēri, Jūhū.

A winter visitor to our area, arriving about September/October and leaving March/April.

Flocks usually contain 6-12 birds either by themselves or in association with Common and Grey-headed Mynas. When they first arrive, the flocks are really family parties or multiples of family parties, and contain a great many young birds in juvenile plumage. Besides their typical frowsy appearance, the young differ from adults in having the crown and head chestnut instead of black, and in the absence of the crest.

The birds feed on grasshoppers and other insects, frequently striding along or hopping amongst grazing cattle. They are also very partial to Banyan and Peepal figs and Lantana berries. We have observed them eating the figs of *Ficus retusa* and berries of *Bridelia* and *Mimusops hexandra*. Along with others of their ilk they may commonly be seen on *Bombax*, *Erythrina* and *Butea frondosa* flowers, the nectar of which seems irresistible. It has quite a sweet song, heard on the approach of the breeding season, and is often kept as a cage bird.

Breeding: We have no evidence that it actually breeds within our limits. The nearest localities where we have found nests are Panchgani (4,000 ft., June/July) and Khandala (2,000 ft.) in the Western Ghats.

The Common Myna: *Acridotheres tristis tristis* Linn.

Local Name: *Shalé* or *Salonki*.

Field identification: After the crow, kite and sparrow certainly the commonest and most familiar bird not only of Bombay and Salsette but of practically the whole of India. A jaunty, perky, well-groomed dark brown bird with glossy black head and neck and bright yellow bill, legs and bare skin around the eyes. In flight a white bar is conspicuous in the open wing, and the tail is also bordered white. We cannot imagine that any local resident old or young is unfamiliar with this bird, but in any case the above clues, down and across,

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should leave no possible doubt in his mind. Usually seen in pairs or family parties in town in suburb and the countryside.

Specimens: *St. Xavier's College*: 32 ♂ Andhēri 28-7-33; 2230 ? Powāi Nov. 34 (H.A.).

Noted: *City*: Grant Road, Bhuleshwar, Warden Road, Esplanade and other maidans, Chowpāti, Back Bay Reclamation, Willingdon Club grounds, etc. *Suburbs and adjacent mainland*: ubiquitous.

Common. Resident. Very partial to water-logged ground where it digs up worms. An unfailing attendant on grazing cattle, prancing with a sideways gait amongst their legs, riding on or hopping about their backs and appropriating any grasshoppers and other unfortunates disturbed by the progress.

When the grass is tall it is amusing to watch the birds springing up from time to time to spy out their surroundings in the manner of a terrier.

The Common Myna is more or less omnivorous in its diet, and like the House Crow will eat anything it can come by. H. A. once saw an individual carry off a dead field-mouse. Banyan and Peepal figs, wild dates or Lantana berries are uniformly relished and the nectar of *Bombax* and *Erythrina* is regularly eaten.

When the winged termites emerge from the ground during the monsoon months, Mynas are amongst the vanguard of the avian epicures that foregather to the feast. They vie with the crows in the ungainliness of their aerial antics after the insects and often dally in the chase till well after dusk.

It has a large repertoire of call notes and being such a familiar and by no means reticent bird, one soon learns to recognise the various emotions expressed by the calls. Alarm, agitation, pleasure, soon become so eloquent that one can usually guess what is afoot long before the birds themselves are visible. The harsh swearing cry of irritation combined with fear, for instance, which is accompanied by a drooping and shivering of the closed wings when a snake is sighted is quite unmistakable. Indeed a great many different species of birds also readily recognise this signal and rally to the moral support of the resentful mynas.

At Kihim we have observed that parties of Common Mynas, often augmented by Jungle Mynas, fly out regularly to the rocks on the sea-shore exposed at low tide. We have been unable to ascertain the true purpose of these flights, but from the short time the birds remain there, we can only conjecture that they do so to drink the salt water in the same way as many mammals do.

Breeding: Nest building commences in May and most eggs may be found in June and July. By September family parties are usually out, the clamouring young being led about and tended by the parents. Two successive broods are not uncommon. The nests in Salsette are placed in holes in stems of date and palmyra palms where they are more or less inaccessible, but holes and hollows in any large tree are utilised. The nest—an untidy collection of rubbish—is frequently built under the eaves or in the ceilings of inhabited houses in the suburbs. Four or five eggs are usually laid of a pretty uniform blue colour with a slight gloss.

The Bank Myna: *Acridotheres ginginianus* (Latham).

Field identification: Like the Common Myna but somewhat smaller and with the general colour pale bluish grey.

A rare straggler (?). Apparently not heard of in our area since 1900. In that year a number of unusual birds were driven far south of their accustomed haunts in search of livelihood owing to the severe drought in Gujerat where the Bank Myna is common (*J.B.N.H.S.*, xiii, 398).

Ten years before this, in 1890, Barnes (*J.B.N.H.S.*, v, 106) wrote: 'I have seen it in the city of Bombay busily employed in excavating holes in the embankment of the Wodehouse Bridge near the Railway Station at Colaba; they did not, however, breed there as the boys persecuted them too much'.

EHA did not meet with it in Bombay (*B. of B.*, p. 127).

The Jungle Myna: *Ethiopsar fuscus mahrattensis* (Sykes).

Field identification: In general appearance not unlike the Common Myna but with a tuft of long black feathers on the forehead, at base of bill, and no bare yellow skin round the eye.

Specimens: *St. Xavier's College*: 145 o? 25-10-33 Kihim (H.A.).

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Noted: *Salsette*: Mulund (once), Kandivlee (once); *Mainland*: common at Kihim (Alibag) and in South Konkan.

The status and local distribution of this myna in our area and the neighbouring country seems curious and inexplicable. On the adjacent mainland—at Kihim, across the harbour, and even at Parsik near Thana—both this species and the Common Myna are equally common. The habits of the two do not seem to differ appreciably except that the former is not so much of a house bird. They breed at the same season, often using the self same nest holes in alternate seasons. Yet in Salsette, except for the one record in all these years by H. A. at Mulund and for another small flock of 5 birds observed by S. A. at Kandivlee in a different year, it appears to be absent! A similar peculiarity in the local and patchy distribution of the Jungle Myna in Travancore has been pointed out by Sālim Ali (*J.B.N.H.S.*, xxxviii, 504).

East of Bombay the farthest we have come across it is 8 miles from Panvēl towards Chauk village. It is common about the Tānsa Lake.

Many years ago Davidson (*J.* v, 107) noted it as occurring in Thana and Bombay.

Breeding: We have found the Jungle Myna nesting commonly at Kihim in May. The nest is a mass of feathers and rubbish finished off with a piece of snake-slough, onion peel or tissue paper! It is placed in natural hollows principally in Casuarina, bhend (*Thespesia*) or Oondi (*Calophyllum inophyllum*) trees 10-30 ft. from the ground. Three or four eggs similar to those of the Common Mynas are laid. The incubation period is 16 days.

(*To be continued*).

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FISH OF DEOLALI.

PART II.

ECOLOGICAL AND BIOLOGICAL OBSERVATIONS.

(With one plate).

BY

A. G. L. FRASER, I.M.D.

CONTENTS.

	PAGE.
Prefatory Note	689
A note on the high mortality incidence observed amongst surface and ground fishes (excepting the *Ophicephalidae*) on their transference from the natural environment to an aquarium	690
Notes on distribution and habits of certain fishes	692
A note on the fixed practice as observed amongst certain species of fish of regularly exercising themselves every evening by swimming about at the surface in the rivers and also when kept in an aquarium ...	702
Temperature variations and alkalinity of the water	
Temperature	706
Alkalinity	708
Miscellaneous Notes	
Sleeping habit of the *Ophicephalidae*	709
Malformations	709
Vernacular Names	709
Notes on a predaceous Water-Beetle which kills stream fishes ...	710
Acknowledgments	711

PREFATORY NOTE.

The following series of notes contains ecological and biological observations made by Mr. A. G. L. Fraser on certain fishes of the Deolali area both under field and laboratory conditions. The author used vernacular names in his descriptions but I have given the corresponding scientific names of the species throughout; in places the text has been revised so as to bring it in conformity with the literature on the subject. Explanatory notes have been added wherever it was found possible to give some adequate reasons for the valuable facts observed by Mr. Fraser. Dr. Albert W. C. T. Herre happened to be in Calcutta when I was revising these notes, and I availed myself of this opportunity to have the matter looked over by him. He very kindly read the revised manuscript and was able to add a note on the surface-swimming habit of the Cyprinidae of the Far East.

The observations recorded here by Mr. A. G. L. Fraser are extremely valuable, especially as they are based on abundant material and were carried out during all the seasons of the year. Special attention may be directed to the function that has been assigned to the hypertrophied lower lip of *Rasbora labiosa* Mukerji and *Danio fraseri* Hora. From an analogy of similar structures found in certain Amphibian tadpoles, it was presumed by Mukerji and the writer that the structure was probably used for hanging from the surface film; but Mr. Fraser has conclusively shown that the enlarged lower lip is meant to seize and hold insects for which the fish jump several inches out of the water. This shows how similar structures may sometimes be used for totally different functions.

The arrangement of matter proposed in the first part had to be modified as the descriptions of new species and notes on rare forms could not be completed in time for inclusion in this part of the *Journal*. In some respects the present arrangement seems to be more suitable.—*S. L. Hora*,

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1. A Note on the High Mortality Incidence Observed Amongst Surface and Ground Fishes (Excepting the Ophicephalidæ) on their Transference from the Natural Environment to an Aquarium.

In the experiences connected with the keeping of fishes in an aquarium, the problem encountered and beset with difficulty was how best to reduce the high mortality which invariably occurs amongst any given number of fishes on their introduction into the aquarium. A rough assessment of this mortality rate shows that 30 per cent die almost at once or within a few hours of the transference. A further 30 per cent. die within 24 hours and 10 per cent. up to 48 hours. In studying these losses with a view to reduction of mortality, the various factors prevailing in the water of the aquarium i.e. (1) temperature (2) alkalinity (3) absence or presence of currents (4) mechanical aëration (6) food supply and (7) the physical character of the bed and the surroundings, were considered in turn and, despite all practical efforts to bring conditions in the aquarium to approach as near as possible those of the river or streams, the mortality figures continued fairly constant. Excluding the *Ophicephalidae,* which were tenacious of life, with a death rate of only 10 per cent., the surface fishes generally showed a higher proportion of deaths as compared with other ground species. No matter what kind of water was used, whether from the river, stream, well or tap, the relatively small percentage of species which ultimately survived were those able to live in any kind of water, provided always, that it was slightly alkaline to litmus paper. Such fishes lived for the five months of observation, even when, as was the case with one batch, the water had not been changed for eleven weeks.

Of the surface fishes, roughly 30 per cent. of the following species survived the transference and showed clear indications of a very high physical capacity for adapting themselves to the conditions in a small improvised aquarium.

(1) *Barbus ticto* (Ham.).—Bhil name :—*Tiptoo*
(2) *Rasbora labiosa* Mukerji.—Bhil name :—*Gayroonjee*
(3) *Danio fraseri* Hora.—Bhil name :—*Gayroonjee*

All these species are found in both rivers and streams in this area. Excepting the first, the two others are normally more numerous in the streams.

In the case of *Barilius bendelisis* Ham. (Bhil name :—*Jhor* or plural *Jhoria*) the mortality in the early trials was cent per cent. Later, it was ascertained that if salt was added to the water in a quantity sufficient to render it strongly alkaline to litmus paper, the death rate was reduced to 90 per cent. Any further additions of salt did not improve the situation and 10 per cent. of any given number survived and could live on if the water was brackish.

Amongst all other surface species which were recovered from the rivers there was a high degree of susceptibility—from 15 minutes to two hours at most—with a cent per cent. mortality which could not be influenced under any circumstances. This I

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think can be attributed to the absence of strong currents which it was impossible to reproduce in a small aquarium. In this respect the Chilwa [*Chela clupeoides* (Bloch)], Bhil name—*Phal* or plural *Phalay* and *Ambassis ranga* (Ham.) with the Bhil name of *Bing* are notable as they were found associated together in sections of the rivers where there were very strong swirling currents in evidence.

The ground species, excepting the *Ophicephalidae,* showed generally a 50 to 60 per cent. mortality and the fishes which best adapted themselves in the improvised aquarium were the following:—

(1) *Cobitidae*: There were four species, viz., *Lepidocephalichthys guntea* (Ham.), *Nemachilus botius* (Ham.), *N. denisonii* Day and *N. evezardi* Day. All of these lived well in the aquarium, but one of them, *L. guntea* (Ham.), with the Bhil name of *Mohroo chopra,* proved to be the better adapted as it lived through the six months of observations.

(2) A ground species (Bhil—*Kharandya*) [*Garra mullya* (Sykes)].

(3) A Siluroid:—Bhil name, *Khirkirya* [*Mystus cavasius* (Ham.)].

In the case of *Garra mullya* (Sykes)—Bhil name, *Mallia*—there was a fifty per cent. death rate but the surviving numbers did not live for more than 4 days in the aquarium and during this period showed much respiratory embarrassment. They periodically and frequently rose to the surface and by muscular action alone, maintained themselves perpendicularly suspended, but not by their lips, for 30 to 35 seconds. While thus engaged, they create a froth of bubbles. This species is really not a good aquarium type. Other ground species showed a cent per cent. mortality.

Most of the ground species were recovered from the rivers. The *Cobitidae* appear to be generally distributed in both the rivers and streams.

The results of the observations made it clear that in a small improvised aquarium only those species survive which are habituated to living in still water pools of rivers and streams or in pools where the currents are only of slight intensity. It would appear, therefore, that if other species are to survive in an aquarium for purposes of observation the water in it must be so arranged that strong currents[1] pass through it at all times and, while allowing of a wide surface expanse its volume and depth must be adequate. These conditions, plus a slight alkalinity and a bed of a varied nature consisting of rock, sand, silt, and under water vegetation to suit the different kinds are equally necessary. It has not been possible for me to do this.

[1] Owing to strong currents, the water becomes well oxygenated and it is usually difficult to keep rapid-water forms in aquaria. By aërating aquarium water artificially, it is, however, possible to acclimatise a certain number of these fishes to aquarium conditions.—*S. L. Hora.*

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The question as to why there should be a high mortality rate amongst the species, of which a small percentage were able to survive the ill-adjusted conditions in a small improvised aquarium, is of interest. Theoretically, if conditions were so adverse as to kill the majority none should have survived. Whether death of the majority was due to shock as the result of a highly nervous complex reacting badly to the new environment is a possible causative factor but not easily ascertainable; but there is no doubt that the few surviving individuals showed a capacity and resistance of a high and peculiar quality, apparently inherent in themselves, for, though placed in an ill-suited environment, they were quite at home in it. Were it not due to this high adaptive power of the few it would not have been possible to carry out the experiments and observations of which the records are appended.

It is possible also that the range of variability is much less among the survivors than in those eliminated. This was found to be the case by the American zoologist, Bumpas who measured 136 injured specimens of the common sparrow collected after a severe storm. Out of this number 72 revived while 64 died. On measuring the dead birds and comparing them with the survivors he ascertained that the former on the average were longer and heavier than the latter and significantly also showed that the range of variability was distinctly smaller among the living birds. In this respect the transference of fishes from their natural environment to the aquarium can be likened to a storm. Unfortunately I am not competent to undertake these measurements of the fishes involved. Such measurements if they are to be reliable must be undertaken on freshly dead specimens as preserved fishes are unsuitable for obvious reasons of shrinkage. I have, however, put up separately in two lots such batches as were observed.—(1) Those that died almost at once or within 48 hours and (2) the numbers which ultimately survived and would have continued to live indefinitely had not the observations terminated for lack of facilities. Should these fishes be measured and the comparative study reveal physical differences it should furnish valuable evidence that those individuals which depart least from the 'ideal type' have on the whole the best chance of surviving.[1]

2. Notes on Distribution and Habits of Certain Fishes.

In the course of making the collection and from the experiences and impressions gathered after eleven months exploration of the tributary streams and rivers in the Deolali area the following

[1] Dr. S. L. Hora of the Zoological Survey of India, who, in collaboration with Mr. K. S. Misra, has investigated the fish fauna of Deolali informs me that the specimens kept in the aquarium for a long time are very lean and attenuated. In fact he found them so different from the normal individual that in the preliminary sorting he regarded them as belonging to different species. This was particularly so in the case of *Lepidocephalichthys guntea* (Ham.) and *Danio fraseri* Hora. Such a condition was probably due to insufficient nourishment under aquarium conditions.

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features were noted as regards the distribution and some of the habits which have been observed.

Serial number and number in order of dominance	Scientific Name	Bhil Name	Present in rivers	Present in streams
1. (29)	*Notopterus notopterus* (Pallas.).	Chambree ...	X	...
2. (33)	*Anguilla anguilla* (Ham.) ...	Ahhir ...	X	...
3. (7)	*Chela clupeoides* (Bloch) ...	Phathree, Phal ...	X	...
4. (2)	*Barilius bendelisis* (Ham.) ...	Jhor ...	X	X
5. (11)	*Danio fraseri* Hora ...	Gayroonjee.	X	X
6. (32)	*Rasbora daniconius* (Ham.) ...	Gayroonjee.	X	...
7. (3)	*Rasbora labiosa* Mukerji ...	Gayroonjee.	X	X
8. (30)	*Aspidoparia morar* (Ham.) ...	Ambli ..	X	...
9. (17)	*Barbus chola* (Ham.) ...	Bhokria ...	X	...
10. (5)	*Barbus khudree* (Sykes) ...	Waris ...	X	...
11. (6)	*Barbus kolus* (Sykes.) ...	Kholis ...	X	...
12. (15)	*Barbus sarana* (Ham.) ...	Bhodeer ...	X	...
13. (1)	*Barbus ticto* (Ham.) ...	Tiptoo, Tiplee ...	X	X
14. (16)	*Cirrhina reba* (Ham.) ...	Arrol ...	X	...
15. (24)	*Crossichilus latius* (Ham.) ...	Warootee ...	X	...
16. (4)	*Garra mullya* (Sykes) ...	Mallia, Kharandya ...	X	X
17. (10)	*Labeo boggut* (Sykes) ...	Sandekol ...	X	...
18. (23)	*Labeo porcellus* (Hackel) ...	Khanoos, Ghoghir ...	X	...
19. (27)	*Rohtee cotio* (Ham.) ...	Goorda ...	X	...
20. (28)	*Rohtee vigorsii* (Sykes) ...	Kuplee ...	X	...
21 (12)	*Lepidocephalichthys guntea* (Ham.)	Mhorroo, Mohroo thail, Mohroo chopra...	X	X
22. (13)	*Nemachilus botius* (Ham.) ...	Mhorroo, Mohroo chickna.	X	X
23. (14)	*Nemachilus denisonii* (Day.) ...	Mhorroo, Mohroo yaree ...	X	X
24. (18)	*Callichrous bimaculatus* (Bloch)	Monee ...	X	...
25. (22)	*Wallago attu* (Bloch and Schn.)	Baloo ...	X	...
26. (9)	*Mystus cavasius* (Ham.) ...	Khirkirya ...	X	...
27. (31)	*Glytothorax lonah* (Sykes) ...	Khordoo ...	X	...
28. (21)	*Nangra viridescens* (Ham.) ...	Bibua ...	X	...
29. (25)	*Proeutropiichthys taakree* (Sykes)	Sonar ...	X	...
30. (20)	*Ophicephalus gachua* (Ham.) ...	Dhakay, Dakhia ...	X	X
31. (26)	*Ophicephalus marulius* (Ham.)	Murral ...	X	...
32. (8)	*Ambassis ranga* (Ham.) ...	Bing ...	X	...
33. (19)	*Glossogobius giuris* (Ham.) ...	Kharbya ...	X	...

In the above Table the species are shown as found (*a*) in the rivers and (*b*) in the tributary streams; their order of

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dominance is also noted. The order of the dominance shown is judged by the numbers taken of each species and is possibly not quite a true index, but it is near enough for all practical purposes. It will be observed from the Table that, of the total of 33 species tabulated, quite a large number found in the rivers, were not found in the streams. Nine species only of the total were found in both the rivers and streams. Of this number only three can be said to be truly stream species. These are *Rasbora labiosa* Mukerji, *Danio (Danio) fraseri* Hora and a ground species with the Bhil name of *Kharandya* [*Garra mullya* (Sykes)]. Their presence in the rivers can be accounted for by the fact that the monsoon storm waters force them in. During the dry seasons of the year their numbers in the rivers are comparatively scanty, while in the streams they are very numerous. The remaining six species appear to be equally distributed in both the rivers and streams.

Chela clupeoides (Bloch).—Bhil name, *Phal* or *Phalay*.

A long, laterally compressed, silvery white fish, stained greenish yellow dorsally. The ventral surface is arched in the long axis; dorsally it is concave, with a sharply upturned mouth. They are recoverable only from the rivers, most often in midstream where the currents are swirling and strongest and in sections where the bed is rocky and sanded or part silted. They move about in shoals and prefer stretches of the river which have a wide expanse, and are absent from sections where there are villages upon the banks. They have been found associated with what appear to me to be *Ambassis ranga* (Ham.), (Bhil name, *Bing*)—a fish so pale and transparent that when alive, the vertebral column, and anteriorly below it and wedged above the stomach, the swim bladder and the bones in its body are clearly defined. After death it becomes opaquely white. With the *Chilwa*, it shares a preference for localities where there are strong currents. *Chilwa* are particularly susceptible and do not live for more than a few minutes in the aquarium. Ten per cent of the *Bing* are capable of living in the aquarium. They never rise to the surface at any time and do not behave as other surface species do. They remain stationary the whole time and rarely if ever move about keeping a position about 2 inches from the floor. They readily devour larvae and also green algae. The mouth is always kept open and only the lower lip is slightly raised in the act of breathing. The *Chilwa* is insectivorous. I have seen them rise to take small blue dragon flies.

Barilius bendelisis (Ham.).—Bhil name, *Jhor* or *Jhoria*.

Hora and Mukerji in the *Records of the Indian Museum*, vol. xxxvii, part iii, have mentioned two species of Barils in their report on the small collection which was first sent from Deolali. The name *Jhor* is used by Bhils for both species. *B. bendelisis* is dark-coloured dorsally with yellowish fins and a series of transverse jet black or purplish black streaks running from a dorsal ridge to the mid-body near the lateral line. In spirits, the dark dorsal colouration

[1] The material sent to us for examination does not bear out, in a few cases, the order of dominance of the species as noted by Dr. Fraser. It is quite possible, however, that we did not have the whole material for examination.—*S. L. Hora.*

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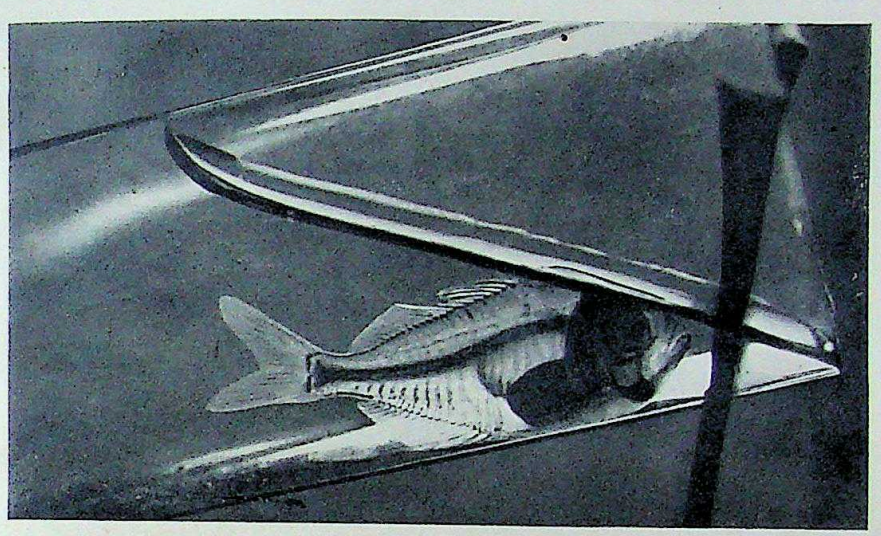

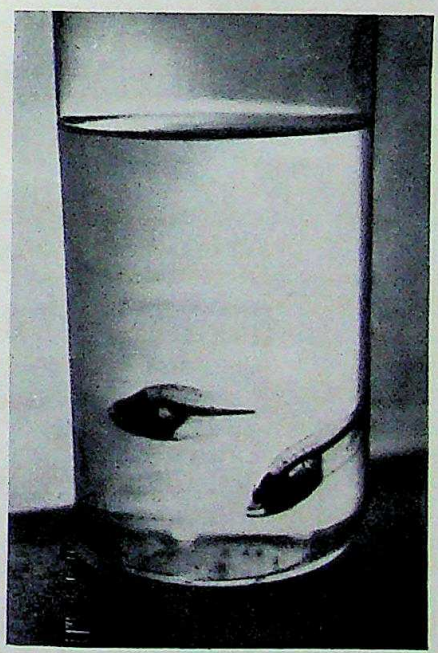

Photos showing the transparency of the fish *Ambassis ranga* (Ham.) known to Bhil fishermen by the name of *Bing*. The swim bladder and vertebral column are clearly defined.

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of large specimens fades to yellow. The young show lighter colour tones and the transverse streaks are much more pronounced. This fish is found both in streams and rivers and favours parts which are silted up and where there is only a mild surface current. During dry periods of the year they are more numerous in the streams, especially in the sections of the 'North Nallah' which run by the Deolali Cantonment Bazaar. Here there is much washing of clothes done and the water is soapy and foul-smelling. Batch No. 32[1] in the present series is a good example of a catch of this species only, containing both large and small specimens taken from the locality mentioned. The water here is always strongly alkaline to litmus paper. This is an important point as this species is a bad aquarium type and I have mentioned previously that a cent per cent. mortality was reduced to 90 per cent. simply by adding salt in sufficient quantity to make the water in the aquarium strongly alkaline. Curiously enough, Batch No. 37 taken on 30th January 1936 from the Darna river were all very young specimens which were caught at the sides of the river in a portion which was but a few inches deep and where there was no current. The bed was a silt-covered sanded section, and here also the water was strongly alkaline, while the temperature at 3 p.m. was 86°F. In contrast with this, the water at a 2 ft. depth in the current of the river was slightly alkaline and the temperature 76°F. No big specimens of this species were caught in this locality on that day. Confirmatory proof of the fact that only this species is recoverable in the section of the 'North Nallah', referred to above in connection with Batch No. 32, is again furnished by the catch obtained on 10th February 1936. Batch No. 39 (see also Batch No. 50 of this series) contains this species. On this day the temperature at 4 p.m. was 86°F. and the water was strongly alkaline. These fish feed well on mosquito larvae and leap for midges when they fly above the surface level. Batch No. 11 containing three specimens were taken on rod and line with a worm bait on 29th August 1935. I have since ascertained that they swallow worms readily. Worms can be got at any time of the year from the section of the North Nallah where this fish is found. The bed is silted over a rocky base and the worms are to be had in the silt and from the edges of the stream. The fish have been observed to partly bury themselves head up in the silt and some have been caught in this way by simply removing the silt and picking them out from it. I have tried silt in the aquarium but this does not help to reduce the mortality. Egg-bearing females were found in March.

Danio (Danio fraseri) Hora.—Bhil name, *Gayroonjee.*

Much of what is given below as regards the habitats of *Rasbora labiosa* Mukerji equally applies to this species which is insectivorous probably throughout its life. The colour in the living state is silvery with a pinkish blush which is also in evidence on the fins. The lateral striations on the long axis of the body are of a blue

[1] These numbers correspond with the locality numbers as given in Part I of the present series.

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colour which fades to just perceptible lines when the fish are kept in the aquarium for any length of time, when they also lose the pink blush, becoming silvery white. In spirits, the striations become quite dark and much of their original freshness is lost.

Rasbora labiosa Mukerji.—Bhil name *Gayroonjee*.

This fish is easily the dominant type in the streams, where they are very numerous. At the origin of the 'Narsullah Wadi' (see bach No. 14—12th September 1935) they were found associated with *Nemachilus denisonii* Day (Bhil name, *Mohroo yaree*, a banded fish). During the dry months of the year comparatively few are recoverable from the rivers, where only adult specimens measuring from 4 to 6 inches in length are usually present. In the streams they have been observed moving about in small shoals—of about 40 or more, consisting chiefly of the smaller fry. They are nearly all of uniform size and appear to have been hatched out at the same time. Very young ones 1.0 cm. in length have been found in the shallows of sanded beds at the edges of the streams where they can be caught by cupping one's hand into a hollow. This is a hardy fish and makes a good aquarium type. They are capable of living in very foul water and were recovered from stagnant pools and the marshy pockets of the streams which become clogged with algae and show a heavy surface scum. Significantly enough 80 to 90 per cent., taken from the stagnant sections survived in the aquarium, provided they were kept under identical conditions in the same kind of foul water with algae in it. A batch was kept for eleven weeks continuously without the water being changed without ill effects. When placed in clear well water the majority of them died within six hours. In contrast with this only 30 per cent taken from clear water in the cleaner parts of the streams, where there was a fair surface current survived in the aquarium. During the rains they are taken in fair numbers from the rivers into which they are washed by the monsoon flood waters. Those in the streams are larvivorous and insectivorous. They feed greedily on the larvae of mosquitoes and midge flies and leap out of the water as much as ten inches high to take flying insects above the surface film. They also feed readily on algae and the flour of a millet grain called in the vernacular 'Bajri' but much prefer adult mosquito and midge flies.[1] The midge flies are seen in the characteristic clouds of their nuptial flight after the rains give over and during the cold months up to February. They appear in numbers at eventide and also at times during the day in flight above the streams. They are particularly in evidence above the stagnant sections and *Rasbora labiosa* and *Danio fraseri* then become very active leaping out for them. Several large specimens of *Rasbora labiosa* were taken on rod and line with a worm bait. One specimen, four inches in length, kept in the aquarium preferred a diet of worms, which it readily devoured and eschewed the larvae and imagos of the insect mentioned. One particularly large example of this species was netted

[1] Mr. Prater in a letter states 'The midges which you sent from Deolali were identified in the British Museum as *Chironomus tripartitum* Rieff.'

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in the act of swallowing a *Nemachilus*. This evidence would go to show that the smaller fry are insectivorous and when grown to adult proportions become carnivorous.

In the publication 'Notes on Fishes in the Indian Museum, xxv. On two New Species of Cyprinid Fishes from Deolali' etc., —*Records of the Indian Museum*, vol. xxxvii, Part II, pp. 375-80, Hora and Mukerji emphasise the characteristic hypertrophy of the lower lip in *Rasbora labiosa* Mukerji and *Danio fraseri* Hora. In the absence of biological observation they found it difficult to assign any definite function to this structure, but directed attention to homologous structures found in certain tadpoles which are supposed to use the hypertrophied lip as a device for hanging from the surface film. They therefore think it is possible that the two new surface species also use the expanded lower lip for the mechanical process of suspending themselves from the surface film when the waters in their habitats become too foul for the ordinary process of respiration. With a view to ascertain whether they behaved in this way, observations were maintained over them and incidentally also over other surface and ground species for a period of five months from 1st November 1935. In the previous notes under mortality incidence, no details were mentioned as to the behaviour of the fishes on the initial transference from their natural environment to the aquarium. The description of this behaviour was postponed for consideration here. The majority of the surface fishes, inclusive of the two new species observed, as also those of the Siluroid family and the ground fish *Garra mullya* (Sykes) (Bhil names: *Mallia* and *Kharandya*) when introduced into the aquarium and dependent upon their powers of adaptability manifest a marked respiratory embarrassment. This they show in the following way. As regards the surface species, the ill adapted rise to the surface and by muscular action alone in the act of swimming maintain themseves as if suspended from the surface film. At the same time the mouth movements in the act of breathing become considerably accelerated; the mouth itself is opened wider and the gill covers are seen to heave to aid respiration. All of these symptoms clearly show the dyspnœa to which they become subjected. In this respect all the fishes behaved alike and in no single instance was there any evidence to show that in this distressed condition they made use of the lower lip in a mechanical way to hang from the surface. Occasionally in the act of swimming the dorsal aspect of the head and sometimes the upper lip was pushed above the surface level, but never the lower lip. When at the surface, the position of the body in relation to the surface film forms angles of a varying degree according to the species. In the case of *Rasbora* the angle formed is roughly 30, of *Danio* 40, of *Barilius* 30, of *Barbus ticto* 60 and of the Siluroids 40 to 60 degrees. They continue to behave in the way described until a moribund phase ensues when they turn over on their backs and finally in a short space of time die. With regard to the ground species referred to above, the behaviour is different. They do not swim about at the surface; instead they remain clinging to the surface by muscular effort in a perpendicular position for half a

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minute or so and then sink back again, repeating the process until moribund and unable to do so any longer. While at the top this ground species produces a froth of bubbles. A similar behaviour, but in a much less active form than the exaggerated behaviour described above, has been observed as a normal daily feature amongst the surface fishes and is regularly resorted to by them as an evening exercise. This form of exercise is unattended by any mortality and will be later discussed in a separate note to follow. As a result of these observations it may be remarked that the hypertrophy of the lower lips and the upward projection of the mouths in the two new Deolali species rather appear to indicate a line of development consistent with their feeding habits. All the evidence gathered with regard to their habits and habitats clearly show that the younger forms of *Rasbora labiosa,* Mukerji are definitely insectivorous, while *Danio fraseri,* Hora is undoubtedly so, probably throughout its life. The rounder and longer bodies of *Rasbora labiosa* are admirably suited to leap out of the water (ten inches) in taking mosquitoes and midge flies which they never fail to secure once they rise. In contrast with them, *Danio fraseri* is unable to rise higher than 4 or 5 inches above the surface level possibly because of its flatter body and shorter length (the largest caught here has not exceeded 4 inches in length); but in this fish also the gripping quality of the lower enlarged lip is so convincing that it leaves no doubt that it is a specialization enabling it not only to seize insects, but also to hold them until back in the water again where it swallows them. I have repeatedly observed their unerring skill in catching insects both in the aquarium and in the streams. A small pocket electic torch fixed by wires and suspended above the open end of the aquarium with the bulb facing upwards furnishes a simple device which attracts numerous flies at sundown and the fish are then seen to perfection demonstrating their ability in rising and taking the flies they want. Undesirable insects, mistakenly seized, are rejected below the water line by a process of blowing them out from the mouth, and in this act the protraction of the lower lip is markedly noticeable. The stagnant pools obviously offer better breeding facilities and attract many insects and the presence of these fishes in such habitats is so explained. One sees a similar upward formation of the mouth in the species of Chilwa—*Chela clupeoides* (Bloch) [Bhil name, *Jhal*]—which is also insectivorous, but the mouth in this species is large and capacious and hence perhaps the need for the development of the lower lip has not arisen as in the case of the two new species, which are comparatively smaller than other Cyprinoids which live on insects, and therefore need some such specialization in a small mouth to ensure success. It may be that certain tadpoles use the hypertrophied lower lip in a mechanical way to aid respiration. Their breathing apparatus in the transitional development from purely aquatic to terrestrial life probably, at a certain advanced stage, allows for breathing in air directly. In the case of the two new Deolali Cyprinoid fishes there is no evidence that they at any time use their enlarged lower lips to hang in a mechanical way from the surface film to aid respira-

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tion. On the other hand there is convincing evidence that they have a capacity for living in the foulest of waters without ill effects[1] and the smaller forms of this species that do so are definitely larvivorous and insectivorous as the stagnant habitats attract numerous insects and ensure a varied and plentiful food supply. The very young ones of both the new species are unable to swallow the larger Culicine larvae but easily devour the smaller Anopheline larvae and those of midges. These very young fishes were recovered during November. Egg-bearing females were found in February.

Barbus khudree Sykes—Bhil name, *Warris*.

This fish has two pairs of barbels. It is silvery white and slightly discoloured dorsally. It favours strong currents in the rivers. It does not live for more than half an hour in a receptacle of water. On this account no observations could be made.

Barbus ticto (Ham.).—Bhil name, *Tiptoo* and *Tiplee*.

This surface species appears to be the dominant type in the rivers. They are localised in sections having villages situated directly upon the banks and here they are very numerous, particularly if the village is a large one with a big population. They are found only in those parts of the tributary streams which run through largely populated areas, such as in the 'North Nallah' up to a point near to Deolali Cantonment Bazaar and the 'Narsullah Wadi' near to the village of Bagoor, and the section which runs through Barnes High School estate, where they are found in relatively small numbers. They are singularly absent in the stretches of both the rivers and streams which meander through open country or tracts given over to cultivation and where there is a complete absence of human habitations. In sections of these open stretches where there is an occasional hamlet or two, they can be got, but only in very few numbers. They favour the shallow edges of the rivers up to a depth of two feet, where the currents are of slight intensity. In the streams they favour stagnant pools or those with a slight surface flow. All the specimens of this species taken from the Godaveri river on 8th December 1935 (batch No. 28) and from the Narsullah Wadi on 19th January 1936 (Batch No. 35) showed a markedly scarlet pigmentation of the body scales; and the caudal, dorsal and ventral fins were similarly stained. On the 8th December 1935, the water in the Godaveri river was very dirty looking, ashen in colour and with green algae, largely in evidence, floating in fragments on the surface scum. Much of their red colouration has been lost through storage in spirits. In other areas, an occasional scarlet stained specimen was recovered. Normally they are silvery white and stained dorsally; with muddy coloured fins and black rays. When kept in an aquarium they lose all the dark staining becoming silvery white

[1] The surface water is, as a rule, better oxygenated, so the surface fishes do not in reality live in very foul waters. It seems also probable that the respiration is aided by taking in gulps of air, as most of the Cyprinoids do, and passing them over the gills.—*S. L. Hora.*

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with very pale fins. They do not for the first week readily feed on the larvae of mosquitoes, but in the course of time and due to the absence of other food, ultimately become larvivorous. They then show much greediness. They also feed on green algae, the dough of any flour and ground particles of roasted 'Bajri' grain. Very young specimens were recovered from the streams during November 1935. Egg-bearing females were found in March 1936.

Garra mullya (Sykes).—Bhil name, *Mallia*.

The mouth of this species points downwards and there is a suction disc on the ventral aspect of the mouth. It is a very dark coloured fish with black fins and the suggestion of a lateral line, as the perforated scales are ill defined against the dark discolouration of the body. These lateral scales are complete. It is found in sections of the rivers and streams which flow over beds of rock. It favours fairly strong currents and depths. Although showing a degree of susceptibility, the species can live for 2 to 3 days in an aquarium. Their behaviour in the aquarium has been described in the previous notes under mortality rates. When lying on the floor of the aquarium the mouth movement in the act of respiration is at a slower rate than that of the surface fishes. They move along the floor with a leaping and wriggling movement. I have not been able to ascertain what they feed upon but since they favour a rocky bed the diet may be a form of algae growing on the rocks. They are generally distributed in both the rivers and streams. Egg-bearing females found in March 1936.

Labeo porcellus (Heckel).—Bhil name, *Khanoos*.

It favours sections of the rivers where there are fairly strong currents and the bed is rock or pebbled and part silted. It is dorsally an elephant grey and laterally and ventrally silvery white. The fins are dark coloured. As it does not survive when removed from its natural environment, no observations could be made.

Cobitidae

Nemachilus botius (Ham.).—Bhil name, *Mohroo chickna*, is a leopard spotted variety. The colouration is a yellow background with black spots and bars and dark yellow fins. *Mohroo chopra* [*Lepidocephalichthys guntea* (Ham.)] is a dark coloured fish with dorsal spots and mottling with a clear black line. It is very thin and attenuated in form. *Mohroo yaree* [*Nemachilus denisonii* (Day)] is a banded variety. The bands are dark and broad and run transversely from the dorsal ridge to the ventral surface.

Mohroo thail resembles in colour *chopra* but the tones are much lighter and it is definitely stouter and heavier in formation.

The Cobitidae are found generally distributed in rivers and streams. They favour the rocky sections and silted and sanded beds where there is evidence of algae growing from the rocks and sides of the rivers. The banded variety, namely *Mohroo yaree*, is more numerous and associated with *Rasbora labiosa* Mukerji at the heads of the streams. They hug the edges of the rivers and the streams where the currents are not too strong.

Lepidocephalichthys not only move their lips in the act of breathing but also rise to the surface to take in air. They do

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this about 12 to 15 times in an hour. They feed well on green algae growths especially the variety which grows on and clings to rocks. When kept with other surface fishes which were fed on the larvae of mosquitoes they were observed in the act of swallowing the larvae. A curious trait noticed is their habit of mouthing the bodies of surface fishes, when these latter were resting stationary a little above the floor of the aquarium. The surface fishes do not resent this action. They are also fond of pushing themselves up the glass surface of the panel, nibbling, as they move, particularly when the panel is covered with a scum of fine earthy particles and slime. These species move along the bottom of the aquarium with a wriggling motion much like a snake and can cling to and climb up an almost upright glass panel. In this respect they show undoubted scansorial powers.

Mystus cavasius (Ham.).—Bhil name, *Khirkirya*.

This cat fish has proved to be a good aquarium fish. They behave much in the same way as surface fish do and regularly exercise themselves by swimming at the surface every evening. During the day they rest at the bottom of the aquarium all huddled together but show the greatest activity at night. They are silvery with a greenish tinge and the fins are light in colour. They feed readily on mosquito larvae and also on worms which they prefer. They are able to move the eye forwards, upwards and downwards. They are susceptible to strong sunlight and show a photophobia and strive to conceal the head by efforts to get under each other or, if there is algae in the water they hide in them. They favour sections of the rivers which have a broad expanse and where the bed is rocky and part silted and are found at the edges at depths up to three feet in currents of mild intensity.

Glyptothorax lonah (Sykes).—Bhil name, *Khardoo*.

It bears a close resemblance to the *Goonch*. When freshly caught and alive, the colour was strikingly beautiful. It lived for barely fifteen minutes and lost colour through storage in preservatives. Originally the post-mortem white markings were a bright red both on the body and the fins and belly and the dark background now seen was a jet black colour.

Nangra viridescens (Ham.).—Bhil name, *Biboa*.

When freshly caught, the colour was a rich gold with some black dorsal markings. They lived for only a half hour and were taken from the Aounda and Darna rivers. It is a recessive type as only a very few were taken.

Ophicephalidae:—There are two species with the following Bhil name :—(1) *Dhakay* or *Dhakaray* (*Ophicephalus gachua* Ham.) is a black fish with the terminal ends of the caudal fins stained a brick red. which fades in preservatives; (2) *Murral* (*Ophicephalus marulius* Ham.):—Dorsally and laterally greenish brown. Ventrally white and a well-defined ocellus superiorly placed upon the caudal fin.

Both species make good aquarium fishes but they are unsociable and attack and kill each other and hence cannot be left together. Both can be kept with other species provided they are regularly fed with worms and bits of meat (raw). If hungry they devour

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the smaller surface species. They appear to be nocturnal in habit as they then manifest the greatest activity by endeavouring to leap out of the aquarium. One kept in a jar by itself succeeded one night in getting out of it. This it must have done at some time after eleven o'clock, when the fishes in the aquarium and those in other receptacles had been inspected by me before retiring for the night. I found this *Dhakay* specimen at six o'clock next morning on the floor to all intents apparently dead. Its skin was dry and hard as a board and the only evidence of life it showed was the fitful movement of one of the forward fins. I placed it in water and it slowly recovered taking in all six hours before regaining its normal state. *Dhakay* are found everywhere both in the rivers and streams. The other species has been taken only from rivers and is also found at the junctions of the streams with the rivers. Both species hug the edges at depths up to two feet and prefer silted areas grown with aquatic vegetation. In the aquarium both rise to the surface to take in air about fifteen times in an hour and always sink back tail first to the floor. They do not normally, when at rest, work the mouth in the act of breathing, but do so only when exercised or under stress of excitement as when engaged in chasing, biting and killing each other. In the absence of the food mentioned they readily swallow the larvae of mosquitoes.

Glossogobius giuris (Ham.).—Bhil name, *Kharbiya*.

Dun or olive coloured background, varying in shade with dark spots laterally and dorsally in the nature of blotches and also on the head.

Kharbiya have been taken from sections where the bed is rock or sand and appear to favour strong currents. Curiously enough they work the mouth in the act of respiration at a slightly slower rate than that of the surface species. They are capable of living in the aquarium for 4 to 5 days only and this inadaptability can be attributed to the absence of currents. I have not been able to ascertain what they feed upon. In all probability their food consists of small crustaceans.

3. A Note on the Fixed Practice as Observed Amongst Certain Species of Fish of Regularly Exercising Themselves every Evening by Swimming about at the Surface Film in the Rivers and Also when Kept in an Aquarium.

The following species were observed for five months. They were kept in large-sized glass receptacles (accumulator jars) which had a surface expanse of 22 inches and a depth of 18 inches of water (approximately six gallons) in each. Other containers such as slop pails (Enamel iron) of four-gallon capacity were also used. About a dozen and a half fishes were kept in each of these containers for which net covers were provided. The species are as follows:—

(1) *Barbus ticto* (Ham.):—Bhil name: *Tiptoo*
(2) *Rasbora labiosa* Mukerji:—Bhil name: *Gayroonjee*
(3) *Danio fraseri* Hora:—Bhil name: *Gayroonjee*

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(4) *Barilius bendelisis Ham.* :—Bhil name : *Jhor*
(5) *Mystus cavasius* (Ham.) :—Bhil name : *Khirkirya*
(6) *Ambassis ranga* (Ham.) :—Bhil name : *Bing*
(7) *Ophicephalus marulius* Ham. :—Bhil name : *Murral*
(8) *Giossogobius giuris* (Ham.) :—Bhil name : *Kharbiya*
(9) *Ophicephalus gachua* (Ham.) :—Bhil name : *Dhakay*
(10) *Garra mullya* (Sykes) :—Bhil name : *Kharandya* and *Mallia*

Excepting (6), (7), (8), (9) and (10), in the aquarium, the first five species, regularly every evening for about two hours between 4.30 and 8.30 p.m. rose to the surface to exercise themselves in much the same manner as has been described under the habits of *Rasbora labiosa* Mukerji. This form of exercises is unattended by any mortality and the fishes do not show any symptoms of dyspnœa. There is evidence also that other surface fishes belonging to the family *Cyprinidae* carry out this practice as a regular feature every evening in the rivers, but as most of those taken from rivers invariably showed a high degree of susceptibility to aquarium conditions, with a cent per cent. mortality incidence, it was found impossible to discover how many of the various species conformed to this practice. It may be remarked that in a general way it is a habit prevailing amongst the majority of surface fishes and at first, it was thought that only such species as are purely insectivorous rise to the surface and swim about in order to feed. This was however later disproved by the observations which were maintained in the aquarium over the five species already mentioned. All resorted to the practice at the regular time even when they had been fed to surfeitment with larvae and imago of mosquitoes and midge flies from 2 to 4 p.m.[1] This experiment was repeated daily for many months and the fed series showed no deviation from the rule, as they instinctively responded to the urge at the regular time as usual without evincing any desire for food although the opportunities offered. The control series which were sparingly fed combined the exercise with attempts to feed by devouring larvae and leaping to take the insects flying above the water level. This evidence led to the consideration that, as the exercise appeared to be a purposive act not specifically associated with hunger, there was some other physiological cause underlying and governing this peculiar behaviour. What this cause may be is, of course, a matter for conjecture. The following notes outline the line of investigations which was followed in an endeavour to find a solution for this enigmatical behaviour of surface fishes and from the facts obtained by experiment and observation a working hypothesis is offered which might possibly help other workers competent to deal with and solve the problem.

It was thought that variations in the temperature of water at various times of the day and evening possibly influenced the fishes

[1] My observation and experience with numerous species of *Cyprinidae* in China and the Philippines is that this peculiar practice is a regular feature in the early morning, from before 6 o'clock until 7 or 7.30 a.m. or until the sun's rays strike the water. The fishes swim at the surface, opening and closing the mouths as if sucking in air.—*Albert W. C. T. Herre.*

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to act in the way they do and so an inquiry in this direction was instituted and extended over a period of several months. These temperature differences will be found recorded subsequently. It may be remarked that, in a general way, the variations in the temperature of the water in the rivers and in the aquarium do not appear directly to influence the behaviour of the fishes as regards their evening exercise. The surface species in the rivers were sometimes seen to rise and swim about at the surface during the mornings and, on occasions, also in the afternoons; but they do this only when a high prevailing wind ruffles the surface and beats it into wavelets. On these occasions it is evident that they come up to the surface actuated by a desire to feed as the wind brings with it a supply of insects for which they actively leap out above the surface film. They nevertheless rise as usual in the evening and go through with their exercise whether a wind is blowing or not. During the dry and hot months of the year—April for example, when the maximum shade temperatures swing between 98° and 106° F.—the temperature of the surrounding air varies and is 5 to 20 degrees higher than the temperature of the water in the rivers; whereas during the cold months (December and January) the temperature conditions are reversed and the air is then colder by about 4 to 20 degrees. In the cold months, a constant feature recorded was that there was a surface coolness of the water in the rivers and also in the aquarium of one degree as compared with that in the depths below. The temperature in the deep parts of the river was ascertained by means of a weighted thermos flask containing a bath thermometer and two open tubes, one running from outside through the stopper to near the bottom of the flask for entry of water and the other ending just under the stopper to let the air out. During the hot weather a surface coolness of half a degree becomes apparent but only at a time when there is a prevailing wind and only in the sections of the river where there is a wide surface expanse with a weak midstream current. In the absence of a wind, there is no difference between the temperature at the surface to that in the depths below and this is also the case in the sheltered pools and narrow parts of the stream and rivers. In the aquarium likewise, there is no difference between the surface temperature and that below in the depths unless the receptacle is well ventilated and placed in a position open to draughts of air and even then the coolness is barely fractional. When the receptacle contains clear well-water, subject to daily changes, the fishes rise and swim about at the surface only once daily every evening for about two hours. This they do apparently quite independently of the temperature conditions, which in the cold weather vary from 56° to 86° and in the hot weather from 74 to 96°F. On the other hand, if the water in the receptacle is rendered turbid with a heavy suspension of mud the fishes rise and swim about at the surface and begin to show some respiratory embarrassment. A few die if the suspension of mud is too thick. They continue to keep at the surface for as long as the water remains muddy. When the mud finally subsides they sink below once again. In such a water they

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tend to keep towards the surface film as the supernatant fluid is generally clearer and less difficulty in respiration is experienced. When the evening hour arrives they begin the exercise as usual.

A striking fact which emerged from the observations is that when the fishes in the receptacle have exercised themselves in the manner described for an hour or so, patches of frothy bubbles are noticed floating or clinging to the sides of the glass panel and these frothy bubbles were absent prior to the exercise. This is a constant feature but it could not be ascertained whether the fishes give out these bubbles or whether they become created mechanically by them in the act of vigorously swimming at the surface. As the appearance of the bubbles is a phase dependent upon the peculiar exercise of the fishes, there is a definite association between the two, and for this reason it would seem that the fishes themselves emit a gaseous discharge while in the act of swimming and this must come from the mouth in the form of tiny invisible particles which, when at the top, coalesce to form the larger visible bubbles normally seen. In the aquarium these bubbles take a very long time before being finally dissipated as some of the floating patches remain intact until the next morning. In the case of the batch of *Rasbora labiosa* Mukerji, referred to in the previous notes, kept for eleven weeks in the same foul water which was never changed, the bubbles in their receptacle accumulated and assumed large proportions and had the character of the frothy saliva seen issuing from the mouths of rabid dogs. The gas, whatever it be, is enclosed in a viscid mucous substance which does not burst readily.

All fishes in the aquarium rise to the surface when symptoms of respiratory failure ensue and this must be so because of the absence of some of the factors of their natural environment, the chief one of which is the amount of available oxygen in the water in the form of dissolved air, which judging from their behaviour appears to be present in a greater volume at the surface. It is well known that if the air which is dissolved in water be expelled from it, the content of nitrogen in this expelled air is in poorer volume in the proportion of 35.1 oxygen and 64.9 per cent. nitrogen as compared with normal air which has 21 volumes of oxygen and 79 of nitrogen and in all probability the lesser pressure at the surface must also help the fishes to easily absorb both the gases. It is possibly for this reason that the Cyprinoid fishes rise to the surface.

[It has hitherto been casually observed to be a general habit among Indian Cyprinoid fishes of sluggish waters, such as rivers, streams, ponds and pools, to rise to the surface towards the evening and to take gulps of atmospheric air, which is usually passed over the gills. Dr. Fraser's observations show that this is a regular habit among the fishes of this class. Presumably, the passing of the air over the gills tones up the filaments to carry on aquatic respiration for the greater part of the day and night, as Cyprinoids are essentially aquatic breathers.

Dr. Fraser has noticed that frothy bubbles are given out by these fishes and that these bubbles are very sticky. The air which is passed over the gills, which are always covered with a thick slimy secretion, probably carries away with it a certain amount of slime which converts the air-bubbles into a frothy mass. When experimenting with the air-breathing fishes, which use

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their gills for aërial respiration, such as the *Mastacembellidae* (*Trans. Nat. Inst. Sci. India*, i, p. 8, 1935), it was noticed that a big frothy mass was produced by the air-bubbles that were given out through the gill-openings. To my mind, Dr. Fraser's observations clearly show that the Cyprinidae resort to aerial respiration for a couple of hours in the evening each day.

As to why the other species of fish enumerated by Dr. Fraser in this note do not swim near the surface in the same way as the Cyprinoids do, the explanation is different for different species. *Ambassis ranga* (Ham.) is very thin and transparent and can probably absorb oxygen all over the surface. *Ophicephalus marulius* (Ham.) and *O. gachua* (Ham.) are provided with special accessory respiratory chambers and are even capable of living in waters totally deficient in oxygen. *Glossogobius giuris* (Ham.) is only slightly adapted to foul-water conditions, but presumably its large gill areas are capable of absorbing a fair amount of oxygen from the water and, unless the water becomes very foul, the fish can extract sufficient oxygen from the water for its needs. Further it is known that species of fish can extract oxygen from water even when the oxygen-tension is very low for a number of normal aquatic breathing fishes.—*S. L. Hora.*]

4. Temperature Variations and Alkalinity of the Water.

Temperature.

Temperatures were taken by means of an ordinary bath thermometer and records were maintained over a period of seven months from November 1935 to May 1936 inclusive. Altogether a total of 315 observations were made in the streams and 330 in the rivers. These totals represent an average of 45 readings taken during any one month, that is, of four registrations made at 6 a.m., 2 p.m., 6 p.m. and once at between the hours from 9 p.m. to 1 a.m. on 12 different days in any one month, which for all practical purposes gives a rough idea of the diurnal ranges of temperature of the water in the rivers and streams in the Deolali area at two seasons, namely:—the cold months from November to February and the hot season from March to May inclusive. Only a few readings were taken at the end of the monsoon period of 1935 and as these records are really in the nature of incomplete data they have not been included in the totals shown above.

These records are shown in the following table:—

During the cold months:—November to February.

	Streams.	Rivers.	Aquarium.	Air.
By Day	60 to 80°F.	66 to 86°F.	66 to 76°F.	50 to 70°F.
By Night	56 to 68°F.	62 to 72°F.	56 to 70°F.	40 to 60°F.

During the hot months:—March to April.

	Streams.	Rivers.	Aquarium.	Air.
By Day	80 to 96°F.	76 to 86°F.	78 to 86°F.	90 to 108°F.
By Night	74 to 82°F.	72 to 76°F.	74 to 78°F.	82 to 92°F.

From the above figures it will be observed that during the cold weather the water in the rivers is slightly warmer than that in the streams. This warmth may be due to the presence of very strong currents, as the temperature of water which rushes strongly was found to be, dependant upon the strength of flow, higher by 2 to 4 degrees than the water in a still pool or that in a stream with a mild surface flow. Conversely during the hot

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weather, the streams are warmer than the rivers. This can be accounted for by the fact that in the dry weather there is much less water in the channels of the streams and there is little or no flow which results in a fair degree of stagnation. Some portions of the stream dry up also and the collections of water in the rocky sections of the *Nallahs* become heated.

Surface temperatures of water: It was found that during the cold weather there was a surface coolness of half to one degree as compared with the temperature below in the depths. In the hot weather the temperature both at the surface and below was identical except when a strong breeze was blowing and ruffling the water's surface when a slight fractional coolness was noted.

Differences between the air and water temperatures during the hot and cold seasons of the year: The peculiarities observed were that during the cold weather the air temperature is lower than that of the water in rivers and streams and aquarium by 4 to 20 degrees and it is higher in the hot months by 5 to 20 degrees. In this connection the few observations made during the rainy season showed that both air and water temperatures appeared to vary little and were fairly constant showing a diurnal range of 65 to 74°F.

Reactions of fishes to extremes of water temperature: It was found that the range of water temperature which conduced to a normal activity amongst fishes as depicted by their behaviour was from 65 to 80°F. Any temperature below 58°F. inactivated them as they then tended to remain at the bottom all huddled together and, if green algae are present in the water, they push themselves into its meshy texture. On the other hand a temperature above 84°F. caused them to exhibit a restlessness in the form of an activity confined to swimming about just below the surface film and in doing this they showed an accelerated breathing rate, but with no signs of actual distress. At temperatures above 90°F. symptoms of acute dyspnœa became manifest.

The following experiments were carried out with a view to ascertain the end points of extremes of water temperature which kill fishes and the tolerance of any acquired for heat and cold. The same number of fishes, previously enumerated were employed in these experiments, namely 10 species belonging to both surface and ground types.

(1) The temperature of the water in the receptacle containing these species was gradually lowered by placing blocks of ice around it. By this means it was ascertained that during the cold weather the minimum temperature which killed both surface and ground species is 48 to 50°F. Conversely (2) also during the cold weather, by heating the receptacle in a water bath the maximum temperature at which fishes died stood at between 92 to 94°F. On the other hand similar experiments carried out during the hot weather showed that the minimum temperature at which fishes became moribund and died was 55 to 58°F. and the maximum at between 102 to 104°F. These experiments clearly showed that fishes at the different seasons acquire or lose a tolerance for heat and cold.

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How far the temperature variations of the water at the different seasons influence the distribution of the species as betwen the rivers and streams cannot be precisely determined but there is evidence to show that the constancy of water temperatures as has been shown to obtain in the rivers may be a factor controlling the distribution, as the variations of the temperature in the waters of the rivers is within the limits of tolerance for the well-being of fishes and the majority of the species found here have their habitat in the rivers. In this connection it may be remarked that the other factors which play an important part in regulating the distribution of the species are (1) Alkalinity of the waters (2) The presence of strong currents (3) The greater volume of water and the wide surface expanse which so far as the rivers are concerned offer to fishes a better environment than that in the streams. I have previously mentioned that there are only three species which can be regarded as truly stream fishes. Two of these are surface species and curiously enough are quite new Cyprinids described by Hora and Mukerji in the *Records of the Indian Museum*, namely :—*Danio* (*Danio*) *fraseri* Hora and *Rasbora labiosa* Mukerji and the other is a ground species with the Bhil name of 'Kharandya' [*Garra mullya* (Sykes)]. There is enough evidence in the collection made of these species that the adults never attain any large dimensions. In the case of river fishes, with but few exceptions the majority grow to a large size. Judged on this evidence it is apparent that the stream environment is unfavourable to fishes generally and the three species mentioned can be regarded as classic examples of fishes which have completely adapted themselves.

Alkalinity.

This was tested by means of red and blue litmus papers reactions. By this test the water in the streams was found to be more alkaline than river water. Well water was slightly less alkaline than either river or stream water. In certain sections of the streams and rivers, where there was an absence of currents, the water was found to be strongly alkaline especially in those areas which were silted up. In some parts of the rivers the reaction was neutral. In no instance did either river or stream water give an acid reaction.

As regards the pH values, crude water from the river tested at the Military Laboratory, Bombay, was found to have the pH standing at 8. Reaction alkaline, turbidity present, free ammonia in a trace. Hardness under 4 degrees. Chlorides 2 parts chlorine per 100,000.

In a slightly acidulated water stream fishes will live for ½ to 1 hour. In distilled water with a neutral reaction stream fishes lived for 3 to 6 hours.

In tap water boiled and cooled and giving a neutral reaction stream fishes showed no distress and lived for several weeks without the water being changed, nor did they die when restored to an alkaline water taken from a well.

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Mention may be made of the fact that *Barilius bendelisis* (Bhil name 'Jhor') was found in somewhat brackish waters. It would appear that a slightly alkaline water suffices for the majority of the fishes in the streams and rivers in the Deolali area.

5. Miscellaneous Notes.

Sleeping habit of the Ophicephalidae.

The two species of fish known to Bhils by the names of *Dhakay* (*Ophicephalus gachua* Ham.) and *Murral* (*Ophicephalus marulius* Ham.) I have been told by Bhil fishermen, have the habit of sleeping on the banks all night. They lie up in the shallows at the edges of the river with their heads partly exposed and this helps them to take air while asleep. There is a good deal of truth in what they say as these species, when in captivity in the aquarium, exhibit a nocturnal activity by endeavouring to leap out of their receptacles and this anxiety would naturally be prompted by the break in the continuity of the habit of resting and sleeping in the way described by the Bhils.

Malformations.

As regards malformations in the body of fishes, there is one specimen of *Rasbora labiosa* Mukerji (Bhil name: *Gayroonjee*) which is of considerable interest as there are several twists in its body length. This specimen when alive behaved quite normally except for a handicap in its swimming speed. The speed was half that of the other normal examples of its species. Another exhibited a tumour-like growth (much like a Goiter enlargement) on the ventral aspect below the mouth. This is important because I have not encountered any malformations in the many specimens of various species taken from the rivers.

Vernacular Names.

The names by which Bhil fishermen differentiate the various species have been cited in the previous notes. They give separate single names to species of the Cyprinoidea, Siluroidea and Ophicephalidae families and in certain examples for some unknown reason assign only one group name to include two or more different species despite the fact that they know them to be distinct types. Only in one case that of the Loaches (*Cobitidae*), do they attempt to separate out the species by employing the group or family word conjoined with another colloquialism to denote the type. I have collected specimens under the names as they were given to me and in this series it will be found that the same names recur for different species. In order to be quite sure that there was a general uniformity amongst the Bhil fishermen in the naming of fishes I obtained information from several fishermen residing in villages as far apart as 20 miles and in each case the vernacular names given by them agreed.

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Note on a predaceous Water-Beetle which kills stream fishes.

Roughly 2 per cent. of fishes secured from the tributary streams had a small aquatic beetle attached to them near the gill aperture. By keeping eleven of these beetles separately in receptacles along with a dozen or more of stream fishes of the following species: *Rasbora labiosa* Mukerji, *Danio fraseri* Hora (Bhil names:—*Gayroonjee*) and *Barbus ticto* (Ham.)—(Bhil name:—*Tiptoo* or *Tiplee*), it was observed that a single beetle killed on an average a dozen of these fishes in the course of 3 to 4 days. They do this by attaching themselves to the gill aperture towards its upper margin and the fish attacked in this way becomes moribund and dies in a matter of 30 to 35 minutes in the case of *Barbus ticto* and up to one hour for the other species mentioned. In the initial attachment of the beetle the fish endeavours to rid itself of the pest by vigorously swimming about in a frenzied manner. This exercise soon tires the fish and the breathing rate becomes accelerated. It then rises to the surface film where it continues to actively move around for 10 to 15 minutes after which the swimming pace is gradually slowed down and at this stage it begins to wobble about and shows much dyspnœa. During this time the beetle without releasing its hold manages, by raising its tail above the surface level of the water, to take air in the form of a bubble into the hind end beneath the elytra. About 8 to 10 minutes after the death of the fish the beetle releases its hold and swims free once again. The death of the fish is apparently brought about by the beetle draining it of blood. The beetles do not eat away the soft parts below the gill covers, which on examination appeared intact. Curiously enough, three of the series of eleven beetles did not kill fishes, although they were left with fishes for the same time period of one week as in the case of the eight beetles which did. The reason for removing the beetles after one week was because those which killed fishes ceased to do so after they had accounted for a certain number—the minimum was 9 and the maximum 14 with an average of 12. On the cessation of the killing operations, the eight beetles without exception made determined efforts to fly out of the aquarium. In contrast with this behaviour those that did not kill evinced no such desire and behaved quite normally by remaining under water and rising to the surface every 2 minutes or so to take the air required for their purpose. These eleven beetles were subsequently killed and examined. Those that killed fishes in the aquarium and also the number which were found attached to fishes recovered from the streams were all females. Of the three which did not attack fishes, two were males and one a female—the male, as is usual with aquatic Coleoptera, is distinguished by a disc-like structure placed on the forepart of the anterior pair of legs. These beetles were not observed in copulation. It may be here remarked that the original observations began with 15 beetles, 4 of these, after killing fishes, escaped during the night from the aquarium and were never seen again.

I have no literature on the subject of beetles and am therefore

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unable to identify the species under reference. Altogether 4 distinct species of aquatic beetles were recovered from the tributary streams and stagnant sections of the rivers in the Deolali area. They all definitely belong to the Pentamera group of Coleoptera as they all show the tarsus with five joints on each of the three pairs of legs and they therefore fall into the main family *Hydradephaga*. One of these species is a black beetle and as it swims only on the water surface and is possessed of short antennae it therefore in all probability belongs to the sub-family *Gyrinidae*. A second species also possessed of short antennae with a greenish black hue appears to belong to the sub-family *Hydrophilidae*. The remaining two fall into the sub-family *Dytiscidae*. One of these is a giant species measuring 4 cm. in length. The other—the particular species under reference in this note—is very small, being only 1.3 cm. in length and 0.6 cm. broad. Both these species have long antennae with eleven segments. The larger of the two is brownish black in colour with the edge of the wing case lined in red. The smaller beetle has a straw-coloured background with some linear black blotches on either side of the wing cases. Specimens of this small beetle have been sent to the Bombay Natural History Society, Bombay, for identification. As regards the giant and other water-beetles mentioned in this note, there was no evidence to bear that they kill fishes.

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My warmest thanks are due to Mr. S. H. Prater, Curator, Bombay Natural History Society, who has helped and encouraged me throughout with valuable suggestions and advice.

(*To be continued*).

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THE MEDICINAL AND POISONOUS CROWFOOTS OF INDIA.

By

J. F. Caius, S.J., F.L.S.

The Ranunculaceæ are annual or perennial herbs, rarely shrubs or climbers. The family includes 40 genera with about 700 species, distributed all over the world, abundant in temperate and cold regions, rare in the tropics and usually at high altitudes.

This is a very important family from our point of view, as owing to the fact that a poisonous, acrid, and narcotic principle prevails in varying degree throughout the Order, there is scarcely one plant which can be regarded as harmless, while some are deadly. However, most crowfoots lose their acrid qualities on drying or cooking. Their roots, when perennial, contain, besides the acrid, a bitter extractive principle, present in various proportions, with a volatile oil, which render them drastic and emetic. Their seeds are acrid; some contain both a fixed and a volatile oil, and are aromatic.

The various members which have been chemically examined have been found to contain (1) *alkaloids*—aconitine, ajacine, ajaconine, atisine, benzaconine, berberine, bikhaconitine, canadine, clematine, coptine, cynoctodine, damascenine, delcosine, delphinine, delphinoidine, delphisine, deltaline, hydrastine, indaconitine, isopyrine, japaconitine, jervine, jesaconitine, lappaconitine, lycaconitine, myoctonine, neopelline, palmatisine, pseudaconitine, septentrionaline, staphisagroine—; (2) *volatile acrid and bitter principles*—anemonin, cimicifugin, nigellin—; (3) *acids*—aconitic, anemonic, isoferulic, valerianic—; (4) *crystalline or amorphous glucosides*—adonidin, delphinin, helleborein, helleborin, paeonin—; (5) *saponins, tannins, resins, oleoresins, sugars* and *fats*.

The better known medicinal and poisonous crowfoots of the world belong to the following 24 genera:—Aconitum (Northern temperate regions); Actaea (Northern temperate regions); Adonis (Northern palaeotemperate regions); Anemone (cosmopolitan); Aquilegia (Northern temperate regions); Caltha (temperate regions); Cimicifuga (Northern temperate regions); Clematis (cosmopolitan); Clematopsis (Nigeria, Tanganyika, Congo, Angola); Coptis (Northern temperate and arctic regions); Delphinium (Northern temperate regions); Eranthis (Northern palaeotemperate regions); Helleborus (Europe; Mediterranean region); Hydrastis (Japan; North America); Isopyrum (Europe, Asia, North America); Knowltonia (South Africa); Myosurus (temperate regions); Nigella (Europe; Mediterranean region); Paeonia (Europe; Asia; western North America); Pulsatilla (Central Europe; Siberia; East Indies); Ranunculus (cosmopolitan); Thalictrum (Northern temperate regions); Trollius (Northern temperate and arctic regions); Zanthorhiza (Atlantic North America).

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The medicinal and poisonous crowfoots of India belong to the following 14 genera:—ACONITUM, ACTAEA, ADONIS, ANEMONE, AQUILEGIA, CALTHA, CIMICIFUGA, CLEMATIS, COPTIS, DELPHINIUM, NIGELLA, PAEONIA, RANUNCULUS, THALICTRUM.

A. Erect or climbing shrubs. Leaves opposite. Sepals petaloid, valvate. Carpels 1-ovuled; ovule pendulous. Fruit of many achenes
Petals 0 ... ... CLEMATIS.

B. Herbs. Leaves radical or alternate. Sepals petaloid, imbricate. Carpels 1-ovuled; ovule pendulous. Fruit of many achenes
I. Petals 0, flowers involucrate ... ... ANEMONE.
II. Petals 0, flowers not involucrate ... ... THALICTRUM.
III. Petals 5-16, with no nectariferous pit ... ... ADONIS.

C. Herbs. Leaves radical or alternate. Sepals herbaceous, imbricate. Carpels 1-ovuled; ovules erect. Fruit of many achenes
Sepals 3-5, deciduous, petals usually 5 ... ... RANUNCULUS.

D. Herbs or undershrubs. Leaves alternate. Sepals petaloid or herbaceous, imbricate. Carpels several, many-ovuled. Fruit of 1 or more follicles (berried in ACTAEA)
I. Flowers regular solitary or panicled
a. Petals 0. Leaves undivided ... ... CALTHA.
b. Petals small, carpels long-stalked ... ... COPTIS.
c. Petals small, unguiculate. Carpels sessile. Flowers pale blue ... ... NIGELLA.
d. Petals as large as the sepals, all spurred ... AQUILEGIA.
II. Flowers regular, racemed
a. Carpels solitary, berried when ripe ... ACTAEA.
b. Carpels 4-8, follicular when ripe ... CIMICIFUGA.
III. Flowers irregular
a. Posterior sepal spurred ... ... DELPHINIUM.
b. Posterior sepal vaulted ... ... ACONITUM.

E. Herbs or undershrubs. Sepals herbaceous imbricate. Carpels several, several-ovuled, girt by a fleshy disk. Fruit of coriaceous few-seeded follicles ... ... PAEONIA.

ACONITUM.

The genus numbers 110 species distributed over the northern temperate regions of the globe.

Aconites are at once highly poisonous and most valuable medicinal plants. The following species are used medicinally in Europe—*A. Anthora* Linn., *A. Cammarum* Linn., *A. Lycoctonum* Linn., *A. Napellus* Linn., *A. variegatum* Linn.—; in Japan and China—*A. Fischeri* Reichb., *A. Lycoctonum* Linn., *A. Napellus* Linn., *A. uncinatum* Linn.—; in North America—*A. Fischeri* Reichb., *A. Napellus* Linn., *A uncinatum* Linn.—; in Indo-China—*A. Fischeri* Reichb., *A. Kusnezoffii* Reichb., *A. Lycoctonum* Linn., *A. Napellus* Linn.

Those aconite alkaloids which have been fully examined belong to two well-defined groups:—(1) aconitines, which are highly poisonous—aconitine and bikhaconitine from *A. Napellus*, indaconitine from *A. chasmanthum*, japaconitine from Japanese hondo aconite roots, pseudaconitine from *A. deinorrhizum* and *A. Balfourii*, jesaconitine from Japanese bushi aconite roots, lappaconitine and

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lycaconitine from *A. Lycoctonum*—; (2) atisines, which are not toxic —atisine from *A. heterophyllum*, palmatisine from *A. palmatum*.

Nothing is known of the properties and uses of 11 species recognized as Indian. The other 13 Indian Aconites are arranged according to the structure of their roots, on the authority of Stapf:—

A. Root perennial, long, fusiform usually breaking up at length into cord-like anastomosing or free strands; old plants often with several stems from the collar ... 1. *A. luridum.*

B. Roots biennial, paired, tuberous; each tuber producing normally one simple or rarely branched stem

I. Stem erect, rarely ascending, never twining

1. Seed-angles winged, faces smooth or almost so (not transversely lamellate)

a. All the leaves distinctly to very long-petioled, cordate-orbicular or reniform in outline, deeply dissected

i. Tubers 2-3.5 cm. long, fracture in the dry state horny or cartilaginous, brown (at least the part outside the cambium); taste slightly bitter, followed by a tingling sensation; carpels 5, glabrous or nearly so, never tomentose ... ... 2. *A. chasmanthum*

ii. Tubers 0.5-2.5 cm. long, fracture in the dry state almost farinaceous, pure white; taste indifferent or slightly sweetish, not followed by any tingling sensation; carpels densely tomentose; honey-gland subterminal ... ... 3. *A. violaceum.*

b. All the leaves with the exception of the lowest shortly petioled to sub-sessile, cordate-ovate, coarsely crenate ... ... 4. *A. heterophyllum*

2. Seeds with hyaline wavy transverse lamellae

a. Cambium of tubers discontinuous, forming in cross-section circular or tangentially flattened to horseshoe-shaped strands

i. Nectary-hood very slender with a minute lip; carpels quite glabrous; taste of tubers intensely and pure bitter, not followed by any tingling sensation ... 5. *A. palmatum.*

ii. Nectary-hood wide with a rather large lip; carpels hairy; taste of tubers rather indifferent, followed by a strong and persistent tingling sensation

† Inflorescence and carpels greyish pubescent; leaves divided almost to the base, ultimate divisions narrow; carpels usually 3 ... ... 6. *A. deinorrhizum.*

†† Inflorescence and carpels spreadingly yellowish tomentose; leaves rather less divided than in the preceding species, ultimate divisions broad; carpels 5 ... ... 7. *A. Balfourii.*

b. Cambium of tubers continuous, forming in cross-section a more or less sinuous ring

i. Secondary sieve-strands of mother-tubers not encased in sclerenchymatic sheaths; lip of nectary widened from the base upwards; leaf-segments not or slightly divaricate

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† Leaves divided to $\frac{3}{4}$ in the inner, to $\frac{3}{4}$ or less in the outer incisions, ultimate divisions rather broad; carpels 5; follicles 10-18 mm. long

¶ Intermediate leaf-division rhomboid-cuneate, sparingly and coarsely inciso-crenate; nectary-hood much leaning forward, slightly widened at the top, scarcely gibbous; carpels glabrous or nearly so; follicles 14-18 mm. long ... ... 8. *A. Falconeri.*

¶¶ Intermediate leaf-division mostly ovate in outline, copiously inciso-crenate or dentate; nectary-hood slightly leaning forward, distinctly gibbous at the top; carpels villous; follicles about 10 mm. long ... ... 9. *A. spicatum.*

†† Leaves divided almost to the very base, ultimate divisions narrow; carpels mostly 3; follicles 18-25mm. long ... ... 10. *A. laciniatum.*

ii. Secondary sieve-strands of mother-tubers encased in sclerenchymatic sheaths, forming persistent fibres; lip of nectary narrow; leaf-segments conspicuously divaricate ... ... 11. *A. ferox.*

II. Stem very slender, twining

1. Flowers on recurved pedicels (up to 5 cm. long), nodding; helmet conic-ovate in profile ... 12. *A. Ekwesii.*

2. Flowers on straight or almost straight pedicels (up to 7·5 cm. long); helmet depressed, semi-orbicular in profile ... ... 13. *A. lethale.*

1. **Aconitum luridum** Hook. fil. & Th. is found in the Himalaya from Eastern Nepal to Chumbi, between 12,000 and 14,000 ft.

The root is reputed poisonous.

Bengal: Bish, Butsnabbish—; *Bhoti*: Tchendook—; *Bombay*: Butchnab—; *Darjeeling*: Soorja banshi—; *Hindi*: Mahoor—; *Nepal*: Atisingeeabish, Bikh, Bish, Bishnak—; *Sikkim*: Suya-banshi—; *Telugu*: Ativassa—.

2. **Aconitum chasmantum** Stapf inhabits the subalpine and Alpine zone of the Western Himalaya, from Chitral and Hazara to Kashmir, between 7,000 and 12,000 ft.

The root contains, according to Dunstan, very small proportions of aconitine (1897). Later the roots were examined by Dunstan and Andrews, and found to contain the crystalline alkaloid indaconitine (1905). But an alkaloid, obtained by Bauer and Radjhan, did not appear identical with indaconitine (1931).

Hazara: Mohri—; *Jhelum*: Mohri, Piun—; *Kashmir*: Ban-bal-nag—.

3. **Aconitum violaceum** Jacquem. occurs in the Alpine zone of the Himalaya from Gilgit to Kumaon, between 10,000 and 15,000 ft.

The roots are eaten by the hillmen of Kanawar as a pleasant tonic.

Kachung: Tilia kachang—; *Kashmir*: Jokser, Jokser me-hin-pat-val—; *Sutlej*: Tilia kachang—.

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4. **Aconitum heterophyllum** Wall. is common in the subalpine and alpine zone of the Himalaya, from the Indus to Kumaon, from 6,000 to 15,000 ft.

Ayurvedists describe the root as a bitter tonic, hot, stomachic, and digestive. They recommend it as a remedy in fevers, diarrhoea, dyspepsia and cough, and also as an aphrodisiac and an astringent. They consider it useful in the treatment of bites and stings from poisonous animals.

Yunanists use the drug much in he same way as the Ayurvedists. Thus the root is a common Indian medicine employed as a mild and bitter tonic, aphrodisiac, antiperiodic and tonic.

The Central Indigenous Drugs Committee (1901) while admitting that the drug is a good bitter and tonic, declared it to be worthless as an antiperiodic. Koman (1919) reported having cured a case of acute dysentery and one of chronic enteritis. Caius and Mhaskar proved experimentally that it is not an antidote to snake venom (1931) and that it is useless in the treatment of scorpion sting (1932).

The alkaloid *atisine* has been obtained from the root.

Bashahr: Patis, Patris—; *Bhoti*: Ais—; *Bombay*: Atis, Atvika—; *Canarese*: Atibaje—; *Cutch*: Ativista—; *Gujerat*: Atavakhanikali, Atavishnikali, Ativakh, Ativish—; *Hindi*: Atis, Atvika—; *Jhelum*: Chitijari, Sukhi-hari—; *Kashmir*: Hongisafed, Mohandigujsafed, Mohundguji, Narmada, Nerr-mada—; *Lahul*: Bonga—; *Leh*: Ais—; *Marathi*: Atavish—; *Persian*: Batis, Vajjeturki—; *Punjab*: Bonga, Chitijari, Patis, Patris, Sukhihari—; *Sanskrit*: Amrita, Aruna, Ataicha, Atisaraghni, Ativisha, Bhangura, Bhringi, Ghunavallabha, Kashmira, Madri, Mahaushadham, Mahoshadha, Mridvi, Prativisha, Pravisha, Shishubhaishyajja, Shokapaha, Shringi, Shringika, Shuklanda, Shveta, Shvetakanda, Shvetavacha, Shyamkanda, Upvisha, Vira, Virupa, Visha, Visharupa, Vishva—; *Tamil*: Atividyam—; *Telugu*: Ativasa—.

5. **Aconitum palmatum** D. Don is found in the alpine Himalaya of Nepal, Sikkim, and the adjoining part of South Tibet, from 10,000 to 16,000 ft.

The non-poisonous root is tonic and antiperiodic; it is given for rheumatism and diarrhoea. Mixed with pepper it is used internally as a remedy for pains in the abdomen, diarrhoea and vomiting, and intestinal worms; externally it is used as an application for rheumatism.

The root contains the alkaloid *palmatisine*.

Bombay: Bikhma, Vakhma, Wakhma—; *Gujerati*: Vakhamo—; *Hindi*: Bikhma, Bishawa, Bishma, Bisma—; *Sikkim*: Gniong-rip-gmok, Setobikhoma—.

6. **Aconitum deinorrhizum** Stapf occurs in the alpine Himalaya of Bashahar.

The root contains the poisonous alkaloid *pseudaconitine*.

Bashahar: Doodhiya moura, Maura, Mohra—; *Gujerat*: Dudhio vachhanag—; *Hindi*: Mahoor, Mahore, Maur, Maura bikh, Mora, Moura bikh, Muhura—; *Kashmir*: Dudhia bish—; *Punjab*: Dudhia bish—; *Ravi*: Dudhia moura—; *Sutlej*: Kala mohra, Mahoor, Mahore, Maur, Maura bikh, Mohra, Mora, Moura bikh, Muhura—.

7. **Aconitum Balfourii** Stapf occurs in the subalpine and alpine Himalaya from British Garhwal to Nepal.

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The tubers contain the poisonous alkaloid *pseudaconitine*.

Darma: Gobriya—; *Garhwal*: Banwa—; *Hindi*: Teliya, Teliya bachnag, Teliya bis—; *Lahore*: Bachnab—; *Nepal*: Gobari—; *Ralam*: Bhanva, Dhaulia, Dhumuriya, Fatkia, Gobaria, Gobriya, Jhirina, Kawriya, Phatkia, Phutkia, Ratwa, Tiliya—.

8. **Aconitum Falconeri** Stapf inhabits the alpine and subalpine zone of the Himalaya of Garhwal.

The root is evidently poisonous.

Hindi: Bikh, Bis, Mahoor, Mahore, Maur, Maura bikh, Meethatellia, Mora, Moura bikh, Muhura—; *Tihri Garhwal*: Mohra—.

9. **Aconitum spicatum** Stapf is found in the alpine zone of the Himalaya of Sikkim and Chumbi, between 10,000 and 12,000 ft.

This species is the principal source of the 'Bikh' or 'Bish' of the Calcutta market. The toxic principle is the alkaloid *bikhaconitine*.

Bengal: Dagra, Dakra, Katbish, Kathbish—; *Bombay*: Bachnab—; *Canarese*: Vasanabhi—; *Cutch*: Bachnaga—; *Deccani*: Lal bachnag—; *Gujerati*: Shingadiovachnag, Vachnag, Vachlanag—; *Hindi*: Bachhnag, Bachnag, Bachnak, Bechnak, Bikh, Bish, Bis, Kalabachhnag, Singya—; *Lepcha*: Ning—; *Malayalam*: Valsanabhi—; *Sanskrit*: Sringibish, Vatsanabha—; *Sikkim*: Bikh, Gniong, Gniongmot, Gniongning, Kalabikoma, Shoddukmot—; *Sinhalese*: Vachanabhi—; *Tamil*: Navi, Sennabi, Vachanavi—; *Telugu*: Nabhi, Vasanabhi—.

10. **Aconitum laciniatum** Stapf occurs in the subalpine and alpine Himalaya of Sikkim and adjoining Tibet, between 10,000 and 14,000 ft.

It forms, together with *A. spicatum*, the article known as 'Nepal Aconite'.

Sikkim: Kalobikhmo—.

11. **Aconitum ferox** Wall. is found in the alpine Himalaya of Nepal.

The drug is chiefly employed in India in the treatment of leprosy, fever, cholera, and rheumatism.

It is a very effective medicine in various diseases, acting as a narcotic sedative, regarded as heating and stimulant, useful in fever, cephalalgia, affections of the throat, dyspepsia, and rheumatism. It is much used as an external application, the root being formed into a paste and spread upon the skin in neuralgia, boils, etc. Internally it is chiefly used in the treatment of chronic intermittent fevers.

Ayurveda prescribes that the root be specially prepared before use. To this end the tough horny material is soaked in either urine or milk from the cow and exposed to the sun until it becomes so soft as to be easily pierced by a pin. The process requires three or more days and the urine or milk has to be renewed every day. Bose (K. C.) has shown that this treatment is attended with very important modifications of the physiological properties :—tincture of Aconite at first slows the heart-rate, lowers the blood pressure, and increases the peripheral circulation, later the heart-rate is accelerated and the blood pressure raised; after

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treatment of the root with cow's urine the tincture increases the rate and systole of the heart, the blood pressure, and the peripheral circulation, and the effects persist for a very long time. Mhaskar and Caius have confirmed those findings and demonstrated, moreover, that if the root is treated with cow's milk, instead of urine, the above changes are much more pronounced.

The root, either alone or in combination with other drugs, has been much recommended for the treatment of snake-bite and scorpion-sting; but Caius and Mhaskar have proved experimentally that the drug is not an antidote to snake venom and is useless in the treatment of scorpion-sting.

A preparation of the root is much used in all the hilly districts in India to poison arrows. The toxic principle is the alkaloid *pseudaconitine*.

Arabic: Bish—; *Assam*: Bish—; *Bengal*: Bish, Butsnabbish, Katbish—; *Bombay*: Butchnab—; *Canarese*: Vasanabhi, Vatsanabhi—; *Cutch*: Buchnaga—; *Gujerat*: Shingadiovachnag, Vachhanag, Vachnag—; *Hindi*: Bachhnag, Bachnak, Bis, Bish, Mahoor, Mithazahar, Singya, Singyabis, Teliyabis—; *Lepcha*: Lung-ji nying, Nyine, Nying—; *Malayalam*: Vatsanabhi—; *Marathi*: Bachnag, Vachnag—; *Nepal*: Atisingeeabish, Bikh, Bish, Bishnak—; *Persian*: Bishnag, Zher—; *Sanskrit*: Aheya, Amrita, Bhugara, Brahmaputra, Darada, Gara, Garada, Garala, Ghora, Halahala, Haridra, Jangala, Jangula, Jivanaghata, Kakola, Kalakuta, Kasakula, Kishala, Kshveda, Nila, Pradipana, Pranahara, Raktashringika, Rasa, Rasayana, Shanklakeya, Shringi, Sowrashtrika, Tikshna, Vatsanabha, Visha—; *Sinhalese*: Vachanabhi—; *Tamil*: Vashanavi—; *Telugu*: Ativasa, Naghi, Vasanabhi—.

12. **Aconitum Elwesii** Stapf is found in the alpine Himalaya of north-eastern Sikkim.

The root is reputed poisonous.

Lepcha: Tukschak gniong—.

13. **Acconitum lethale** Griff. occurs in the higher parts of the Mishmi mountains.

The root contains the non-poisonous alkaloid *palmatisine*. It is, however, believed to be the source of the celebrated 'Bhi' or 'Bis' poison of the Mishmis.

Mishmi: Bee, Bih, Bhi, Bis—.

Actaea.

This genus consists of 10 species distributed over the northern temperate regions.

A. alba Mill., *A. eburnea* Rydb., and *A. spicata* Linn. are used medicinally in North America by the Meskwaki, Pillager Ojibwe, and Forest Potawatomi Indians of the State of Wisconsin.

Actaea spicata Linn. occurs in the temperate Himalaya from Hazara to Bhutan. It is distributed to Northern Asia, Europe, and North America.

The root is an active emeto-purgative, acrid, parasiticide; it is held in repute as an expectorant and antispasmodic. It must be administered with caution.

Canadian doctors administer the root in snake-bite; and it is said to be attended with much success in the treatment of nervous

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diseases, rheumatic fever, chorea and lumbago. The berries were formerly used internally for asthma and scrofula, and externally for skin complaints.

The Pillager Ojibwe and the Forest Potawatomi Indians of Wisconsin make a tea from the root, to be drunk by women after childbirth; it is meant to clear up the system. White men use it for stomach troubles, and as a substitute for *Cimicifuga racemosa* Nuttall. It has been used in cases of ovarian neuralgia, uterine tenderness, sub-involution, and as a substitute for digitalis in the treatment of fatty or irritable heart. It affords some relief for a headache which is due to eye strain.

In some parts of Europe the powdered leaves, stems, and flowers are used as an insecticide. The toxic principle is referred to as 'oil of baneberry'.

Mhaskar and Caius have shown that the root is useless as an antidote to snake-bite.

Catalan: Herba de San Cristófol—; *English*: Baneberry, Bugbane, Grapewort, Herb Christopher, Toadroot—; *French*: Actée, Actée en épi, Christophoriane, Faux hellébore noir, Herbe aux poux, Herbe de saint Christophe—; *German*: Christophskraut, Christophswurz—; *Italian*: Barba di capra—; *North America*: Coral-and-pearl, European Baneberry, Grapewort, Herb Christopher, Poison-berry, Red Baneberry, Red-berry Snakeroot, Red Cohosh, Snake-berry, Toad-root—; *Ojibwe*: Wickobidjibîk—; *Potawatomi*: Wasgobîdjibikeok—; *Spanish*: Cristobalina, Yerba de San Cristobal—.

Adonis.

The genus numbers 10 species inhabiting the northern palaeotemperate regions, chiefly southern Europe and western Asia.

A. aestivalis Linn., *A. autumnalis* Linn., *A. microcarpa* DC., *A. vernalis* Linn. are used medicinally in Europe; *A. vernalis* Linn. is similarly used in North America.

The herb of *A. vernalis* Linn. is official in Austria, Holland, Italy, Russia, Spain, and Switzerland.

Adonis aestivalis Linn. extends from temperate Europe to Asia; it is found in the Western Himalaya from Peshawar to Hazara and Kumaon.

The whole plant is used as a cardiotonic and diuretic in Euope. The flowers are considered laxative, diuretic, and lithothriptic.

Baluchi: Buchki—; *Catalan*: Ull de perdiu—; *French*: Adonide d'été, Rougeotte—; *German*: Feuerroeschen—; *Languedoc*: Rubissa—; *Reggio*: Pe d'esen—; *Romagna*: Chiga sanev, Erba corta, Fior d'Adone, Gattapozzia—; *Russian*: Goritzvyet Krasnee—; *Sardinia*: Ogu de boi—; *Spanish*: Ojo de perdiz—; *Treviso*: Gioze de sanguse, Stiantamalanni—; *Wasiri*: Chadangul, Lavang—.

Anemone.

This cosmopolitan genus numbers 100 species.

The following are used medicinally in Europe—*A. alpina* Linn., *A. coronaria* Linn., *A. hepatica* Linn., *A. narcissiflora* Linn., *A. nemorosa* Linn., *A. pratensis* Linn., *A. pulsatilla* Linn., *A. ranunculoides* Linn., *A. stellata* Lam., *A. sylvestris* Linn., *A. trifolia* Linn., *A. vernalis* Linn.—; in North America—*A. acutiloba* Laws.,

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A. cylindrica A. Gray, *A. dichotoma* Linn., *A. parviflora* Michoe., *A. patens* Linn., *A. pratensis* Linn., *A. thalictroides* Linn., *A. virginiana* Linn.—; in Japan and China—*A. cernua* Thunb.—; in Indo-China—*A. cernua* Thunb., *A. dichotoma* Linn., *A. hepatica* Linn., *A. japonica* Sieb. and Zucc., *A. nikoensis* Max.—; in South Africa—*A. caffra* Harv., *A. transvaalensis* Prantl.—.

The leaves and flowers of *A. nemorosa* Linn. are official in Portugal, those of *A. pulsatilla* Linn. in France and Portugal.

A. multifida Poir. and *A. nemorosa* Linn. are reputed poisonous in America.

In Siberia the juice of *A. altaica* Fisch., *A. narcissiflora* Linn., *A. parviflora* Mich., *A. ranunculoides* Linn., *A. reflexa* Steph. is used to poison arrows.

Anemonin, or anemone camphor, has been obtained from *A. nemorosa, A. pratensis, A. pulsatilla,* and *A. transvaalensis.*

1. Achenes strigose, rarely glabrous. Radical leaves 3-partite ... ... *A. obtusiloba.*

2. Achenes nearly orbicular with an incurved beak. Leaves palmately 5-partite ... ... *A. narcissiflora.*

1. **Anemone obtusiloba** D. Don occurs in temperate and alpine Himalaya from Kashmir to Sikkim, between 8,000 and 15,000 ft.

In Hazara the pounded root, which is acrid, is mixed with milk and given internally for contusions. In Bessahir it is said to be used as a blister, but to be apt to produce sores and scars.

The seeds, if given internally, produce vomiting and purging. The oil extracted from them is used in rheumatism.

Jaunsar: Ageli—; *Kumaon*: Kakriya, Ratanjota, Rattanjog—; *Punjab*: Padar, Ratanjota, Rattanjog—.

2. **Anemone narcissiflora** Linn. is found in Kashmir. It is distributed to the Alps of Southern and Central Europe, Western Asia, Siberia, and North-Western America.

The plant is toxic and is used as a poison in most places where it is found growing.

Aquilegia.

The genus consists of 75 species occurring in the northern temperate regions.

A. alpina Linn., *A. Kitaibelii* Schott, *A. parviflora* Ledeb., *A. pyrenaica* DC., *A. vulgaris* Linn. are used medicinally in Europe; *A. canadensis* Linn., *A. formosa* Fisch., *A. vulgaris* Linn. are similarly used in North America.

Aquilegia vulgaris Linn. is found in the Western temperate and subalpine Himalaya; it is distributed over temperate Europe and Asia.

In Europe the plant and the seeds are credited with aperient, resolvent, diuretic, and diaphoretic properties. The leaves are generally used in lotions with good success for sore mouths and throats. A tincture is employed to strengthen the gums.

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'Tragus saith that a dram of the seed taken in wine with a little saffron openeth obstructions of the liver and is good for the yellow jaundice, if the person after taking thereof be laid to sweat well in bed. The seed also taken in wine causeth a speedy delivery of women in childbirth; if one draught suffice not let her drink a second, and it will be found effectual. The Spaniards used to eat a piece of the root thereof in a morning fasting, many days together, to help them when troubled with stone in the veins or kidneys.'

The plant contains a cyanogenetic glucoside.

Catalan: Ausellets, Corns, Perfet amor—; *Dutch*: Akelei—; *English*: Blue Starry, Boots-and-shoes, Capon's-feather, Capon's-tail, Cock's-foot, Colombine, Colourbine, Columbine, Cullavine, Culverkeys, Culverwort, Curranbine, Dove's-foot, Granny's Night-cap, Hawk's-feet, Hen and Chickens, Lady's shoes, Lady's slippers, Snapdragon, Sowdwort, Two faces under a hat—; *French*: Ancholie, Ancholie commune, Ancholie des jardins, Ancholie sauvage, Ancholie vulgaire, Ancolie, Bonne-femme, Clochette, Colombine, Cornette, Eglantine, Fleur-églantine, Galantine, Gants de Notre-Dame, Gélantine, Manteau royal—; *German*: Acklei, Adlerblue, Adlersblume, Aglei, Akelei, Falsche Glockenblume, Glockenblume, Harlekinsblume, Jowisblume, Jupiterblume, Unsererliebenfrauen-handschuh—; *Italian*: Amor mascosto, Aquilegia, Aquileia, Aquilina—; *Roumanian*: Caidarusa, Cinci coade, Clopotei cornuti—; *Russian*: Vadasbor—; *Spanish*: Aquileña, Aquileña, Manto real, Pajarilla, Pajaritas—; *United States*: Boots-and-shoes, Cock's-foot, Culverwort, Dove's-foot, European Columbine, Garden Columbine, Granny's-nightcap, Hawk-feet, Lady's-shoes—.

CALTHA.

The genus numbers 20 species inhabiting the temperate regions of the world.

Caltha palustris Linn. is found in western temperate Himalaya from Kashmir to Nepal, between 8,000 and 10,000 ft. It occurs in temperate Europe and North America.

Every part of the plant is strongly irritant, and cases are on record of serious effects produced by rashly experimenting with it. The juice is efficacious in curing warts.

Internally, the boiled young sprouts were used by the Iroquois in rheumatism and neuritis.

In the Pyrenees and in Germany the young buds are pickled like capers.

A tincture made from the whole plant when in flower may be given in cases of anaemia, in small, well-diluted doses.

Catalan: Flor del mal d'ulls—; *English*: Bassinet, Big Watercup, Blob, Boots, Bublican, Bull-flower, Bulls' Eyes, Butter-blob, Carlock-cups, Chirms, Christ's Eyes, Claut, Colt's Foot, Crow Cranes, Crazy, Dandelion, Drunkard, Fire o'Gold, Golden Cup, Goldins, Golds, Gollin, Great Butter-flower, Ground Ivy, Halcups, Horse-blobs, John Georges, Johnny Cranes, Kingcob, King Cup, Leopard's Foot, Mare-blebs, Mare-blob, Marsh Horsegowl, Marsh Mallow, Marsh Marigold, May Blobs, Mayflower, Meadow Bouts, Meadow Bright, Meadow Gowan, Moll-blob, Open Gowan, Palsywort, Publicans and Sinners, Soldiers' Buttons, Water-blobs, Water-bouts, Water Buttercup, Water Caltrops, Water Dragon, Water Goggles, Water Gowan, Wild Bachelor's Buttons, Yellow Gowan—; *French*: Populage, Souci d'eau, Souci des marais—; *German*: Butterblume, Dotterblume, Kuhblume, Sumpfdotterblume—; *Italian*: Farferugine—; *Menomini*: Wäsasipu 'Kwa—; *North America*: American Cowslip, Cowslip, Cow's Lip, Marsh Marigold—; *Ojibwe*: O'îgîte'bûg—; *Punjab*: Baringu, Mamiri—; *Spanish*: Calta, Centella palustre, Yerba centella—.

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Cimicifuga.

This genus consists of 12 species, which inhabit northern temperate regions.

C. foetida Linn. is used medicinally in Europe, China, and Indo-China; *C. racemosa* (L.) Nuttall in North America, where the dried rhizome and roots are official.

Cimicifuga foetida Linn. inhabits temperate Himalaya from Kashmir to Bhutan, between 7,000 and 12,000 ft. It is found in Siberia and Eastern Europe.

The plant is a nerve depressant.

In Europe the root is considered a mild emeto-purgative. In China and Indo-China it is used as an antiperiodic and sudorific, and prescribed in rheumatic affections, dropsy, the early stage of phthisis, and chronic bronchial diseases.

In Siberia the root is used to drive away bugs and fleas.

Annam: Thang ma—; *Chinese*: Sheng Ma—; *English*: Bugbane—; *French*: Actée fétide, Chasse-punaise, Cimicaire, Herbe aux punaises—; *German*: Wanzenkraut—; *Punjab*: Jiunti—; *Spanish*: Yerba de las chinches—.

Clematis.

A cosmopolitan genus numbering 220 species, rare in the tropics.

This genus is acrid and poisonous; the leaves and fresh stems, if bruised and applied to the skin, cause vesication; in some species the seeds have purging properties.

The following species are used medicinally in Europe—*C. alpina* Mill., *C. flammula* Linn., *C. integrifolia* Linn., *C. recta* Linn., *C. vitalba* Linn., *C. viticella* Linn.—; in Indo-China—*C. apiifolia* DC., *C. chinensis* Retz., *C. dioica* Linn., *C. florida* Thunb., *C. paniculata* Thunb., *C. patens* Morr. and Dec., *C. smilacifolia* Wall., *C. virginiana* Linn., *C. vitalba* Linn.—; in China—*C. apiifolia* DC., *C. chinensis* Retz., *C. paniculata* Thunb., *C. recta* Linn.—; in North America—*C. crispa* Linn., *C. ligusticifolia* Nutt., *C. viorna* Linn., *C. virginiana* Linn.—; in Jamaica—*C. dioica* Linn.—; in Guinea and Nigeria—*C. grandiflora* DC., *C. Thunbergii* Steud.—; in the islands of Mauritius and La Reunion—*C. mauritiana* Lam.—; in Madagascar—*C. Bojeri* Hook., *C. mauritiana* Lam., *C. saxicola* Bojer and Hills.—; in Southern Africa—*C. brachiata* Thunb., *C. stanleyi* Hook., *C. stewartiae* Burtt-Davy—.

A. Achenes with long feathery styles. Flowers in axillary fascicles; pedicels 1-flowered ... ... 1. *C. napaulensis.*

B. Achenes with long feathery tails. Flowers in axillary panicles

I. Filaments glabrous, connective of anthers not produced

a. Glabrous ... ... 3. *C. smilacifolia,*

b. Silky ... ... 2. *C. triloba.*

c. Young parts pubescent ... ... 4. *C. gouriana.*

II. Filaments hairy, connective of another not produced ... ... 5. *C. graveolens.*

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1. **Clematis napaulensis** DC. is found in teemperate Himalaya from Garhwal to Bhutan. In Kumaon throughout, between 4,500 and 7,000 ft., in shady moist ravines.

In Kanawar the leaves are said to act deleteriously on the skin.

Kumaon: Ghantiali, Jai, Kanguli—; *Punjab*: Birri, Pawanne, Wandak—.

2. **Clematis triloba** Heyne inhabits the Bombay Presidency: Konkan and Deccan, Western Ghats.

It is applied externally to boils and itch, and to parasitic worms.

It is prescribed for the treatment of snake-bite; but Mhaskar and Caius have found every part of the plant equally useless in the antidotal treatment of snake-bite.

Bombay: Moravela, Moriel, Morvel, Ranjae, Ranjai—; *Canarese*: Morhari—; *Gujerat*: Morvel—; *Hindi*: Churahar, Dhantiali, Murhari—; *Marathi*: Moravela, Morbel, Ranjai—; *Matheran*: Morvel, Ranjat—; *Porebunder*: Trekhdovelo—; *Sanskrit*: Murva, Devashreni, Devi, Dhanurmala, Dhanurguna, Dridhasutrika, Gokarni, Laghuparnika, Madhulika, Madhurasa, Madhushreni, Madhusrava, Morata, Piluparni, Prithakaparni, Snigdhaparni, Snuva, Tejani—; *Sind*: Maruva—.

3. **Clematis smilacifolia** Wall. occurs in Kumaon, the Himalaya from Sikkim eastwards up to 5,000 ft., Assam, Ganjam, Konkan, Kanara and Deccan of the Bombay Presidency. It extends to Indo-China, Java, Borneo, and the Philippine Islands.

In Indo-China a decoction of the roots is used for aching of the muscles.

Canarese: Hottuhambu—; *Indo-China*: Day ong lao, Khoua kau san, Linh tien—; *Lepcha*: Krang rik—; *Malayalam*: Vatiyampu—; *Sinhalese*: Narawel—; *Telugu*: Gurraputige—.

4. **Clematis gouriana** Roxb. is found in the Punjab hills, the Western Himalaya up to 5,000 ft., the hilly districts throughout India between 1,000 and 3,000 ft., and Ceylon. It is distributed to Java and the Philippine Islands.

The leaves of the fresh stems, if bruised and applied to the skin, cause vesication.

Bombay: Moriel, Morvel, Ranjai—; *Canarese*: Telejadari—; *Dehra Dun*: Belkangu, Belkum, Belkun—; *English*: Indian Traveller's Joy—; *North-Western Provinces*: Belkangau, Belkun—; *Saora*: Pannedang, Pedutivva—; *Uran*: Golarang—; *Uriya*: Boromojhanti, Idiya—; *Visayan*: Calupad, Tolangsangbanug—.

5. **Clematis graveolens** Lindl. inhabits the Western temperate Himalaya to Kumaon, between 6,000 and 11,000 ft., and extends to Baluchistan, where it is considered poisonous.

Baluchi: Hushokawal—.

COPTIS.

This genus consists of 10 species which are found in the northern temperate and arctic regions of the world.

C. anemonaefolia Sieb. and Zucc. is used medicinally in Malaya, Indo-China, Japan, and North America; *C. teeta* Wall. in India, Malaya and China; *C. trifolia* Salisb. in North America.

Berberine has been isolated from *C. teeta* and *C. trifolia*.

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The dried rhizome of the species growing in Japan is official in the Japanese pharmacopoeia.

Coptis teeta Wall. grows in the temperate parts of the Mishmi mountains, east of Assam.

The root is an all-round tonic and stomachic medicine. It has been found to produce excellent effects in debility, convalescence after fevers and other debilitating diseases, atonic dyspepsia, and in mild forms of intermittent fevers.

It is used in Sind, Assam, and other parts of India for restoring the appetite, being given in infusion; also as an appliation on sores and for inflammation of the eyes.

It contains berberine and coptine.

Assam: Mishmeeteeta, Tita—; *Bombay*: Mamiran, Mishmitita—; *Cantonese*: Choon lin—; *Chinese*: Huang Lien—; *English*: Coptis, Gold Thread—; *French*: Coptide— *Hindi*: Mamira, Mamiran, Mishmitita—; *Malaya*: Choon lin—; *Sind*: Mahmira—; *Sinhalese*: Pitakarosana—.

Delphinium.

The genus numbers 150 species, natives of temperate regions in the northern hemisphere.

The flowers are acrid, bitter, astringent; the seeds are emetic, cathartic, anthelmintic, and insecticidal.

The following species are used medicinally in Europe—*D. ajacis* Linn., *D. consolida* Linn., *D. elatum* Linn., *D. grandiflorum* Linn., *D. hybridum* Willd., *D. laxiflorum* DC., *D. montanum* DC., *D. orientale* Gay., *D. palmatifidum* DC., *D. peregrinum* Linn., *D. pubescens* DC., *D. staphisagria* Linn., *D. triste* Fisch.—; in Indo-China—*D. ajacis* Linn.—; in North America—*D. ajacis* Linn., *D. consolida* Linn., *D. staphisagria* Linn.—.

Deltaline has been isolated from the whole plant of *D. occidentale* S. Wats., and delcosine from *D. consolida* Linn.

Ajacine, and ajaconine have been isolated from the seeds of *D. ajacis;* delphinine, delphisine, delphinoidine, and staphisagroine have been obtained from the seeds of *D. staphisagria.*

D. consolida Linn. in flower is official in Portugal; the seeds of *D. staphisagria* Linn. are official in France, Holland, and Portugal.

I. Spur subulate
   1. Radical leaves 5-15 cm. diam., orbicular, divided to the base or nearly so, 5-9-parted. Follicles 3. ... 1. *D. denudatum.*
   2. Radical leaves 3-4 cm. diam., suborbicular, 5-7-lobed. Follicles 5 ... ... 2. *D. caeruleum.*
   3. Radical leaves 10-15 cm. diam., orbicular or reniform, 5-7-lobed or -parted. Follicles 3 ... 3. *D. elatum.*

II. Spur inflated, conical ... ... 4. *D. Brunonianum.*

1. **Delphinium denudatum** Wall. occurs in the Western temperate Himalaya from Kashmir to Kumaon, between 8,000 and 12,000 ft.,

Ayurveda doctors consider the bitter root as cooling, vulnerary, and alexiteric. They recommend its use for diseases of the blood, and for the treatment of snake-bite and scorpion-sting.

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Yunanists describe the root as a stimulant in conditions of debility, a brain tonic useful in insanity, an analgesic good in tooth ache and in painful piles, an antidote to snake and scorpion venoms. The drug promotes appetite, but it is strongly binding and a purgative should be administered with it.

In Bashahr the root is used for tooth ache, and also as an adulterant for aconite.

Mhaskar and Caius have shown that the root is not an antidote to either snake or scorpion venom.

Arabic: Judwar, Mahferfin—; *Bhutia*: Nirbisi—; *Canarese*: Nirvishi—; *Gujarat*: Nirvishi—; *Hindi*: Judwar, Nirbishi, Nirvisi—; *Jaunsar*: Main—; *Marathi*: Nirvishi—; *Nepal*: Nilobikh—; *Persian*: Zadwar—; *Punjab*: Judwar—; *Sanskrit*: Apavisha, Avisha, Nirvisha, Vishabhava, Vishaha, Vishahantri, Vishavairini, Vivisha—; *Simla*: Manila—; *Sind*: Judwar—; *Urdu*: Jadwar—.

2. **Delphinium caeruleum** Jacq. is found in the alpine Himalaya from Kumaon to Sikkim, up to 17,000 ft. in the Eastern Himalaya.

The root is applied to kill the maggots in the wounds of goats.

Punjab: Dakhangu, Dhakangu—.

3. **Delphinium elatum** Linn. spreads over the western temperate Himalaya from Kashmir to Kumaon, between 10,000 and 12,000 ft.

The whole plant, but more especially the seed, is emetic, aperient, diuretic, and anthelmintic.

This plant is found growing in Europe where the seeds are used as insecticides, and much employed in the treatment of itch and other skin eruptions. The flowers are astringent and used in troubles of the eye.

The toxic principles are delphinine, delphisine, and delphinoidine.

4. **Delphinium Brunonianum** Royle grows in the alpine region of Western Tibet at an altitude of 14,000 ft.

The juice of the leaves of this plant is used in Kurram to destroy ticks in animals, chiefly when they affect sheep. In Leh it is considered so poisonous that the dew from the leaves falling on grass is said to poison cattle and horses.

Garhwal: Kasturi—; *Kumaon*: Nepari—; *Ladakh*: Ladara—; *Pangi*: Mundwal—; *Ravi*: Sapfalu—; *Sutlej*: Laskar, Liokpa, Panni, Ruskar, Spet, Supalu—.

Nigella.

The genus includes 16 species, natives of the Mediterranean region and Central Europe, one of them cultivated and run wild in India.

The following are used medicinally in Europe—*N. arvensis* Linn., *N. damascena* Linn., *N. hispanica* Linn., *N. sativa* Linn.—; in Syria—*N. orientalis* Linn.—; in Algeria and the Hadramaut—*N. arvensis* Linn.—; in Malaya and North America—*N. sativa* Linn.—.

Nigella sativa Linn. is found in the Punjab and Bihar, sometimes cultivated and an occasional weed of cultivation. It extends to the Mediterranean region.

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The seeds when bruised are strongly scented, and they are used in Europe as emmenagogues, diuretics, and galactagogues. They are carminative and are an excellent adjunct to purgative draughts. Put among woollens, furs, etc., they prevent the attack of insects.

In the Presidencies of Bengal and Bombay the seeds are given to nursing women to promote the secretion of milk. In the Punjab they are reckoned stimulant, and are administered by hakeems in milk for rheumatism and cough. It is said they were at one time used in place of pepper.

The oil expressed from the seeds is employed for the same purposes as the seed.

In eruptions of the skin the seeds reduced to powder and mixed with sesamum oil are much used in India as an external application.

Koman found the seeds useful in mild cases of puerperal fever.

The seeds have been recommended for the treatment of snake-bite and scorpion-sting; but Mhaskar and Caius have demonstrated that they are not an antidote to snake venom, and that they are useless in the treatment of scorpion sting.

Afghanistan: Shewadaru, Siyahdaru—; *Arabic*: Habbat-us-suda, Hab-es-souda, Kamun-e-avad, Shoonez, Shuniz—; *Bengal*: Kalajeera, Kalijira, Kalzira, Mugrela—; *Bombay*: Kalenjira, Kalonji—; *Burma*: Samonne—; *Canarese*: Karejirage, Karijirigi, Karimsiragam—; *Deccan*: Kulanjan—; *Egypt*: Habb-suda, Hubsindee, Kamnun iswid, Niyeh—; *English*: Black Cummin, Fennel Flower, Nutmeg Flower, Roman Coriander, Small Fennel—; *French*: Cumin noir, Faux cumin, Nielle de Crète, Nielle romaine, Nigelle cultivée, Nigelle romaine, Quatre épices, Toute épice—; *German*: Schwarzkuemmel, Gemeiner Schwarzkuemmel, Roemischer Schwarzkuemmel—; *Gujerati*: Kalonjijirum—; *Hebrew*: Qesah—; *Hindi*: Kalajira, Kalonji, Mugrela—; *Iraq*: Habbat-soda—; *Italian*: Cinnamonea, Cuminella, Erba spezie—; *Kashmir*: Tukmigandna—; *Malaya*: Ku sheng—; *Malayalam*: Karunchirakam, Karunshiragam—; *Mauritius*: Cumin noir, Nigelle—; *North America*: Black Caraway, Black Cumin, Fitch, Roman Coriander—; *Persian*: Shuniz, Siahudanah, Siyahbiranj—; *Punjabi*: Kalvanji—; *Russian*: Tchernushka—; *Sanskrit*: Bashpika, Kalajaji, Karava, Karavi, Krishnajiraka, Kunchi, Kunchika, Kunjika, Musavi, Prathvika, Prithivi, Prithu, Prithuka, Prithivi, Sthuljiraka, Sushavi, Upakunchiraka—; *Sinhalese*: Kaluduru—; *Tamil*: Karunjiragam—; *Telugu*: Nellajeelakara, Nullajilakara—.

Paeonia.

This genus numbers 15 species distributed over Europe, Asia, and the western part of North Africa.

The following are used medicinally in Europe—*P. corallina* Retz., *P. Moutan* Sims, *P. officinalis* Linn., *P. peregrina* Mill., *P. tenuifolia* Linn.—; in Japan, China, and Indo-China—*P. albiflora* Pall., *P. Moutan* Sims—; in California—*P. Brownii* Dougl., *P. officinalis* Linn.—.

Paeonia emodi Wall. is found in the Western Himalaya from Kashmir to Kumaon.

The tubers of this plant are highly esteemed by hakeems as a medicine for uterine diseases, colic, bilious obstructions, dropsy, epilepsy, convulsions and hysteria. *Ud-salap* is generally given to children as a blood-purifier.

In Booner, the root in combination with other drugs is a favourite remedy for bruises, sprains, etc.

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An infusion of the dried flowers is highly valued as a remedy for diarrhoea.

The seeds are emetic and cathartic.

Bhutia: Bhumamadiya, Yetghas—; *English*: Himalayan Paeony, Paeony Rose—; *Hindi*; Udsalap—; *Kashmir*: Mid—; *North-Western Provinces*: Chandra—: *Punjab*: Mamekh—; *Urdu*: Udasaliba—.

Ranunculus.

The genus includes 300 species distributed all over the world, but most numerous in temperate or cool regions.

The following species are used medicinally in Europe— *R. acris* Linn., *R. arvensis* Linn., *R. asiaticus* Linn., *R. bulbosus* Linn., *R. falcatus* Linn., *R. Ficaria* Linn., *R. Flammula* Linn., *R. glacialis* Linn., *R. gramineus* Linn., *R. hederaceus* Linn., *R. Lingua* Linn., *R. monspeliacus* Linn., *R. muricatus* Linn., *R. pedatus* W. & K., *R. parviflorus* Linn., *R. repens* Linn., *R. sceleratus* Linn., *R. Thora* Linn., *R. trichophyllus* Chaix, *R. trilobus* Desf.—; in China—*R. acris* Linn., *R. sceleratus* Linn.—; in Indo-China—*R. Langsdorfii* DC., *R. pensylvanicus* Linn. f., *R. sceleratus* Linn., *R. ternatus* Thunb.—; in North America—*R. abortivus* Linn., *R. bulbosus* Linn., *R. Flammula* Linn., *R. multifidus* Pursh., *R. sceleratus* Linn.—; in Madagascar—*R. pinnatus* Poir.—; in South Africa—*R. capensis* Thunb., *R. pinnatus* Poir., *R. pubescens* Thunb.—.

A. Water plant. Flowers white ... ... 1. *R. trichophyllus.*

B. Land plants. Flowers yellow

I. Achenes smooth or granular, not muricate or tubercled, shortly beaked

1. All leaves undivided, lanceolate, entire or remotely toothed ... ... 2. *R. Lingua.*
2. Leaves 3-partite. Achenes many in an oblong head, not margined ... ... 3. *R. sceleratus.*
3. Leaves ternatisect. Achenes smooth, glabrous, margined ... ... 4. *R. pensylvanicus.*

II. Achenes tubercled or muricate

1. Sepals appressed to and half the length of the petals ... ... 5. *R. arvensis.*
2. Sepals reflexed, rather shorter than the petals ... 6. *R. muricatus.*

III. Achenes gibbous at the side with a long terminal beak. 7. *R. falcatus.*

1. **Ranunculus trichophyllus** Chaix is found in the plains of the Punjab, in the Western Himalaya from the Indus to Kumaon ascending to considerable elevations, in Waziristan, Baluchistan and Afghanistan whence it extends to North Africa and Europe and spreads over the temperate parts of both hemispheres.

The amount of toxic principle is so small as to be negligible and, in Europe, the plant is given in intermittent fevers, rheumatism, and asthma.

English: Water Crowfoot, Water Fennel—.

2. **Ranunculus Lingua** Linn. occurs in Kashmir; it is found throughout the temperate zone of the northern hemisphere.

In Europe the leaves are applied as a blister to the wrists in rheumatism.

English: Great Spearwort, Sparrow Weed, Sparrow Crowfoot—; *French*: Grande douve, Renoncule lancéolée—; *German*: Grosser Hahnenfuss—.

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3. **Ranunculus sceleratus** Linn. is found in Mount Abu, Sind, Waziristan, Northern India, the warm valleys of Himalaya, and Bengal; it extends to Siam and the temperate zone of the northern hemisphere.

The plant is an emmenagogue and a galactagogue; it is much used in the treatment of skin diseases.

The fresh plant is poisonous, and produces violent effect if taken internally. The bruised leaves form an application to raise blisters, and may also be used to keep open sores caused by vesication, or by other means.

The leaves are still used occasionally in Europe as a vesicant. When made into a tincture with spirit of wine, and given in small diluted doses, the plant proves curative of stitch in the side, and of neuralgic pains between the ribs, likewise of pleurisy without feverishness.

In Indo-China the seeds are given as a stomachic, to destroy foul breath, to reduce abscesses, and in kidney troubles.

The plant contains an acrid volatile oil, an inert resin, and a narcotic principle called *anemonin.*

Arabic: Kafessaba—; *Catalan*: Gata rabiosa—; *Chinese*: Shih Lung Juei—; *Danish*: Puggepebe—; *Dutch*: Water haanewoet—; *Egypt*: Zaghalanta, Zaghlul—; *English*: Celery-leaved Buttercup, Celery-leaved Crowfoot, Marsh Crowfoot, Water Celery—; *French*: Grenouillette aquatique, Grenouillette d' ean, Herbe sardonique, Mort aux vaches, Renoncule des marais, Renoncule scélérate—; *German*: Blasenziehender Hahnenfuss, Boese Ranunkel, Boesewicht, Froscheppich, Giftranunkel—; *Indo-China*: Thach long noi—; *Italian*: Appio riso, Erba sardonica, Pie corvino, Ranocchiella aquatica, Ranunculo di palude—; *Kumaon*: Shim—; *North America*: Biting Crowfoot, Blisterwort, Cursed Crowfoot, Marsh Crowfoot, Water Celery—; *Persian*: Kabikaj—; *Portuguese*: Ranunculo mataboi—; *Spanish*: Ranunculo malvado—; *Tirhut*: Polica—.

4. **Ranunculus pensylvanicus** Lin. fil. is found in the Upper Gangetic Plain, the Nepal Terai, the Khasia hills up to 6,000 ft.; it extends to North China, Amur-land, and North America.

The plant is used to raise blisters.

Indo-China: Tieu hoi hoi toan—.

5. **Ranunculus arvensis** Linn. occurs in the Western Himalaya from Kashmir to Kumaon, in Mount Abu, in Afghanistan, extending to temperate Asia, Siberia, Europe, and North Africa.

In Europe the plant is used in intermittent fevers, gout, and asthma.

As a fodder it frequently produces symptoms of irritant poisoning.

The leaves are said to contain hydrocyanic acid.

Baluchi: Zardphul—; *Boya*: Kanjarvaliai—; *Egypt*: Zaghalantah—; *English*: Corn Buttercup, Corn Crowfoot, Crow's-claws, Devil-on-both-sides, Devil's-claws, Devil's Coach-wheel, Devil's Currycomb, Dill-cup, English Staves-acre, Field Crowfoot, Goldweed, Gye, Hard-iron, Hedge-hog, Hellweed, Horse Gold, Hungerweed, Jack-o'-both-sides, Joy, Peagle, Prickle-backs, Scratchbur, Starveacre, Yellowcup, Urchin Crowfoot, Yellow Crees—; *French*: Bassinet des champs, Picot, Piguereaux—; *Malta*: Devil's Claws, Hedgehog—; *Miram Shah*: Zirgulac—; *Punjab*: Chambul—; *Spanish*: Coronilla de la Virgen, Gata rabiosa, Yerba del amor—; *Waziri*: Peri makhlak, Sarsundan—.

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6. **Ranunculus muricatus** Linn. occurs in the Punjab and Punjab Himalaya, Kashmir, Western Asia, Europe, and North America.

In Europe the plant is used in intermittent fevers, gout, and asthma.

Egypt: Zaghlil—; *Spanish*: Abrojos a cuatro—.

7. **Ranunculus falcatus** Linn. occurs in Kashmir, Punjab, Baluchistan, Western Asia, and South-eastern Europe.

The plant when pounded and applied to the skin produces blisters.

Baluchistan: Wahwashu—; *Pushtu*: Karamghundai—.

THALICTRUM.

The genus consists of 80 species which inhabit the northern hemisphere.

The following are used medicinally in Europe—*T. angustifolium* Linn., *T. aquilegifolium* Linn., *T. flavum* Linn.—; in Indo-China—*T. aquilegifolium* Linn., *T. flavum* Linn., *T. foliolosum* DC.—; in North America—*T. polycarpum* S. Wats.—; in South Africa—*T. minus* Linn.—.

Achenes short, oblong, ribbed, subsessile. Leaves ternately or pinnately decompound.

1. Stem 4-8 ft. glabrous. Achenes usually 2-5, small, oblong ... ... *T. foliolosum.*
2. Stem 2-4 ft. erect. Achenes 5-8, oblong ... *T. minus.*

1. **Thalictrum foliolosum** DC. is found throughout the Himalaya between 5,000 and 8,000 ft., the Khasia hills between 4,000 and 6,000 ft., Burma, and Siam.

The root combines tonic and aperient properties, and has been found useful in convalescence after acute diseases, in mild forms of intermittent fevers, and in atonic dyspepsia.

The root is largely used as an *anjan*, or application for ophthalmia in Afghanistan and throughout India.

In the Punjab, the root is used as a purgative and diuretic.

Arabic: Mamiranchini—; *Bengal*: Gurbiani—; *Bombay*: Mamiran—; *Hindi*: Mamira, Pilijari, Pinjari, Shuprak—; *Kashmir*: Chaitra—; *Kumaon*: Barmat, Penglajari, Pilajari—; *Persian*: Mamiranchini—; *Punjab*: Chireta, Chitramul, Gurbiani, Keraita, Mamira, Pashmaran, Phalijari—.

2. **Thalictrum minus** Linn. is found in the inner valleys of the Temperate Himalaya, and in West Tibet between 9 000 and 12,000 ft.; it is distributed to Northern Asia, Europe, Abyssinia and Southern Africa.

An infusion of the leaf or a decoction of the root is used by the Sutos for fever.

Sosuto: Lefokotsane, Tloro-ya-ngwale—.

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THE NAMES OF TWO INDIAN VIPERS.

By

Malcolm Smith, M.R.C.S.

[*From the Dept. of Zoology, British Museum (Natural History)*].

Trimeresurus popeiorum, nom. nov.

The discovery by Mr. and Mrs. Pope that the snake generally known as *Trimeresurus gramineus,* the Common Green Pit Viper (*sensu* Boulenger), included four species, was due largely to their investigation of the hemipenis. This work has not yet met with general acceptance, but no one who has critically examined it can doubt the correctness of their observations.

The four species distinguished by them were *gramineus, stejnegeri, albolabris* and *occidentalis.* Two distinct types of hemipenis were defined, namely, a short spinous type found in *stejnegeri* and *occidentalis,* and a long, calyculate, spineless one, found in *gramineus* and *albolabris.* The character of the hemipenis is the only one by which *gramineus* (*sensu* Pope) can be distinguished from *stejnegeri;* in all external morphological characters the snakes resemble one another and none has been found yet by which to distinguish the females.

T. gramineus was restricted by them to the Indo-Chinese region, its most westerly limit being Darjeeling and the Jalpaiguri district in the Eastern Himalayas, a region which is mainly Indo-Chinese in its fauna. For the species which inhabits the Peninsula of India no name was available, and they called it *occidentalis.* This choice was unfortunate,, for the type locality of *T. gramineus* Shaw, based on Russell's 'Bodroo Pam', described and figured by him in his *Indian Serpents,* p. 13, pl. ix, is Vizagapatam, and is well outside the range of *gramineus* as defined by Mr. and Mrs. Pope. Russell's description of the colour is as follows:—'The head and trunk and tail of a fresh green; the last row of squamae on the belly yellow. The scuta of a pale straw colour and some of them have a small, green spot on each side.' This peculiar coloration of the ventrals, that is, the green of the dorsal scales, splashed over as it were, on to the ventrals, is well shewn in the coloured figure and it is found only, though not in every specimen, in the snake which inhabits the Peninsula of India.

I feel convinced therefore that the name *gramineus* Shaw should be applied to the Indian snake and *T. occidentalis* will become a synonym of it. For the *gramineus* of Mr. and Mrs. Pope no name is available and I have pleasure in connecting theirs with it.

Ancistrodon nepa Laurenti.

In 1908 Col. Wall described a new Viper from Ceylon under the name of *Ancistrodon millardi* (*J.B.N.H.S.,* xviii, p. 792). It

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had been confused with *A. hypnale* Merrem but differed in having more ventrals and subcaudals and in slight differences in the proportions of the head shields. Later he discovered that the name *hypnale* should have been applied to the snake with the high ventral and caudal count and he therefore reversed the names (*idem*, xxx, 1925, p. 248). Such action however is not possible under the Rules of Zoological Nomenclature which state that a name once published cannot be rejected, even by its author, because of inappropriateness (Art. 32).

A name however is already available for this snake. An examination of the hemipenes of the two species shews that they differ from one another in exactly the same way as do *Trimeresurus stejnegeri* and *T. popeiorum*, the hemipenis of *hypnale* being calyculate and without spines, that of the other strongly spinous. This permits Laurenti's name *nepa* (*Coluber nepa, Syst. Rept.*, 1768, p. 97) based on a figure in Seba (I, pl. 19, fig. 7), and relegated by Boulenger with a query to the synonymy of *hypnale*, to be used. Seba's figure shews an undoubted Viper, like *hypnale*, with an everted and spinous hemipenis, the very character in fact which is needed for diagnosis. The fact that the snake was said to have come from Madagascar need not concern us, for many of Seba's localities are known to be incorrect. Moreover no member of the Viperidae is known to inhabit that Island.

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GAME BIRDS IN THE ANAIMALAI HILLS AND THE SOUTH COIMBATORE DISTRICT.

By

J. Williams.

(*Witht one plate*).

On reading some of Mr. Stuart Baker's books on Game Birds recently I found remarkably few references to the occurrence of Game Birds in this area. I have done a lot of wandering with a shot gun during the past thirteen years, and the occurrence of birds which I have been able to identify may be of some use to the Society's records. The area over which I have shot may be divided into two sections.

(1) The developed area of tea known as the Anaimalai Planting District with Valparai as its centre, together with the Grass Hill and Sholah country above it.

The planted area was originally dense evergreen rain forest, some of which still exists between the estates and the Grass Hills. Planting of tea, coffee, cardamoms, and cinchona was started about 1898, but the bulk of the estates were opened much later between the years 1917 and 1930. The planted area is now about 30,000 acres, and is all on a plateau of undulating country between 3,000 and 4,500 ft. high. There are belts of original forest, coffee under planted shade, and blocks of cardamoms under original forest, throughout the district, but the bulk of the area is open tea land.

There are no paddy fields in the area at all, but throughout the tea there are small patches of swamps and perennial streams some of which are covered with heavy scrub, and some of which are open. The rainfall varies between 120 and 300 inches a year for different parts of the district. The bulk of this falls in the S.W. monsoon between June and August, but more or less heavy showers occur in most months of the year except January, February and March which are very dry.

The Grass Hill country runs up to 8,000 ft. and is short grass dotted with thick patches of stunted forest very similar to the Nilgiri plateau. It connects us with the High Range district in Travancore.

Game Birds are nowhere very numerous, but the following have been shot or seen in the area.

The Fantail Snipe. [*Capella gallinago* (Linn.)].

This bird frequents the swamps and streams throughout the planted area. Of recent years they have been much more numerous; presumably they did not frequent the country at all when it was under dense evergreen forest 30 to 40 years ago.

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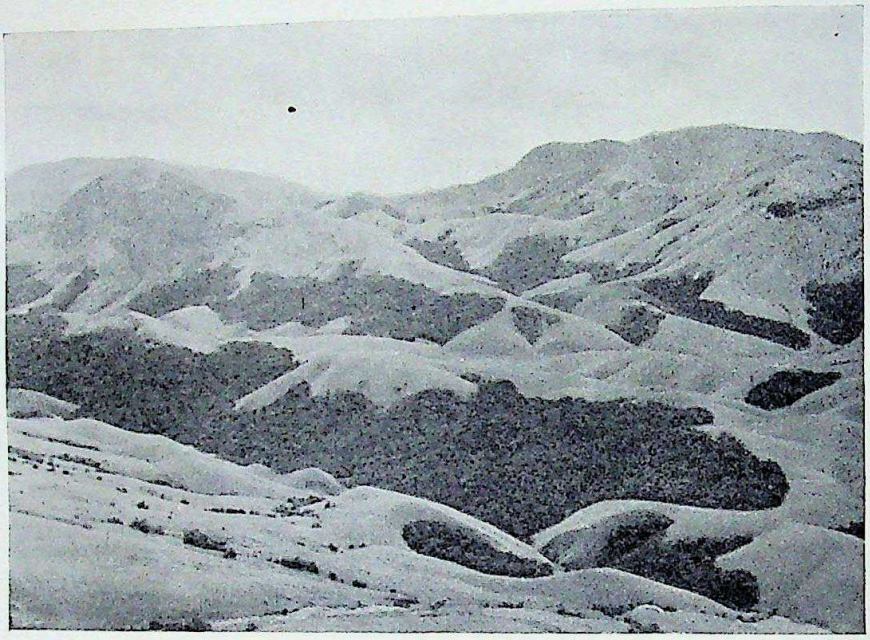
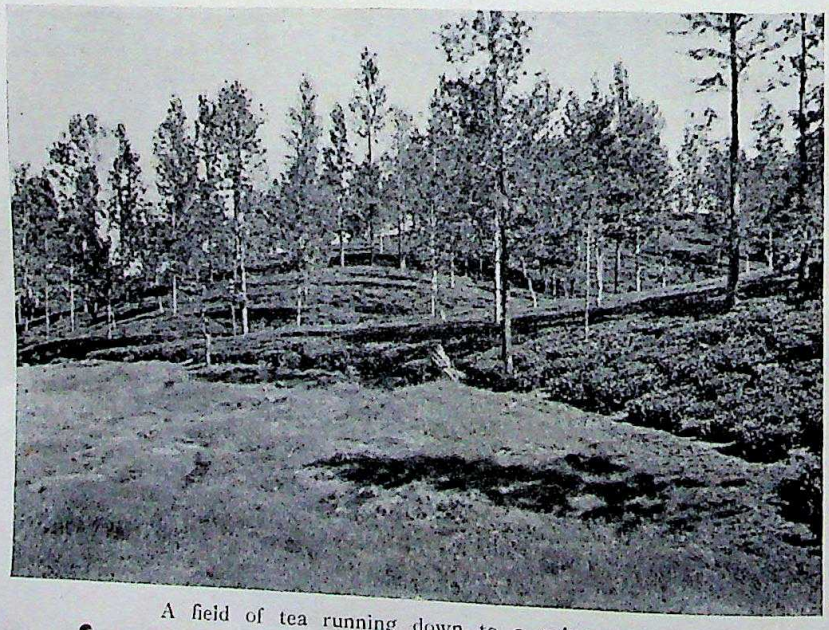


The Grass Hills—Kornelar Valley.



A field of tea running down to a snipe swamp.

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They come in late in October and when they first arrive can be found in large wisps on favourite patches of ground. I believe that many of these birds continue their migration further afield, but many split up and remain here until late April.

Many swamps which are apparently good ground never hold a bird. The birds take to the tea and scrub as soon as the sun gets hot and will not move out of it. Some of the best swamps are in very public spots where coolies are continually passing, and one of the best I know is within 100 yards of a tea factory with cooly lines all round it and a main road along one side. Few of the birds in this swamp bother to leave it at the first beat. An average morning when birds are plentiful is a bag of 5 to 6 couple to two guns shooting between 6 and 8 a.m. This snipe is also found occasionally in bogs on the Grass Hills. I have seen them there in January and February.

The Pintail Snipe. [*Capella stenura* (Bonaparte)].

This season I shot one of these birds in December in the tea district. The swamp in which it was shot was almost dry. This is the only Pintail I have seen or heard of up here.

The Wood Snipe. (*Capella nemoricola* Hodgs.).

This season in December Dr. R. M. Yeo shot a Wood Snipe whilst walking up a swamp on Pannimade Estate with me. This is the only one that has so far been recorded up here.

The swamp was a very big one which had been drained into main channels, all of which had bushy scrub growing over them as an antimalarial measure. The ground between the drains was covered with tussocky grass and low scrub. This swamp sometimes holds Fantail Snipe, but it was at the time very dry and there were none there.

We saw three Wood Snipe but did not at first realise what they were, and mistook them for Water Rails on account of their very languid flight and their curious habit of flopping into scrub cover. After shooting one we tried to put the others up again, but in spite of having a dog we only got one of them to move. This flew a short way before going down again for good and never gave a fair shot. These three birds were scattered at some distance from each other over an area of about 10 acres.

Woodcock. (*Scolopax rusticola* Linn.).

There are only two records of this bird having been shot up here. The first was shot by the late Mr. Cooper on Castlecroft Estate in the tea some years ago. This year another was shot by Mr. G. B. Reade on the Grass Hills. It was beaten out of a small patch of sholah between 6,000 and 7,000 ft. up, and was the only one seen.

Jungle Fowl. (*Gallus sonneratii* Temm.).

Grey hackle jungle fowl are common all over these hills at all elevations. They do not seem to have a very clearly defined breeding season. The bulk of the chicks are hatched out in April,

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May and June in the tea district, but I have seen chicks in the tea in November, December and January. It is curious that, like so many of our birds and animals in this area, the young should be brought into the world to face the very inclement weather of our S.W. monsoon soon after they are born. I imagine that the reason for this is that the food supply in the form of insects, seeds, and vegetation is most abundant in the month or two preceding the monsoon, when all plant life wakes up under the stimulation of warm showers following several dry months.

Spur Fowl. [*Galloperdix spadicea* (Gmelin.)].

The red-legged spur fowl is not common, and does not seem either to increase or decrease in numbers. It is scattered throughout the area.

Quail.

I have seen occasional small coveys of five or six birds in the short grass on the lower slopes of the Grass Hills at 5,000-6,000 ft. I am not sure which variety this is as I have had very little experience of quail. The bird is dark between the colour of a grouse and a partridge. It is also bigger than the lighter coloured bird which is so common in the foot-hills.

As mentioned in my note I am not quite sure which variety of quail this is. The following might be added to this note.

This quail is probably either the Common Quail or the Rain Quail. Two years ago a pair of these birds nested in April in the garden of the bungalow of Akkamallai Estate. The nest was built under a large white lantana bush and the chicks were hatched out successfully. Akkamallai Estate is a tea estate which runs up to the foot of the Grass Hills and the elevation of the bungalow is about 6,000 ft.

The Quail is I think a resident bird as I have seen them at various times of the year, both in the dry weather and in the S.W. monsoon which is very heavy on these hills.

Imperial Pigeon. [*Ducula badia cuprea* (Jerd.)].

These birds are very common all over the area, both in the tea district and in the Grass Hills. In the tea district they live in the tops of very tall trees, on whose fruits they feed. They are particularly partial to the fruit of the Dammar tree (Tamil, *Kungele Maram*) from which comes the Dammar gum of commerce. This fruit is like a fair-sized blue plum, and has a thin rind with a hard stone centre. Half a dozen of these—each fruit as big as the bird's own head—can be squeezed out of the crop of a dead bird. The Imperial Pigeon has an articulated jaw which allows the beak to gape to an incredible extent, and this explains the apparent miracle. I have never discovered what the bird does with the stones which are about three-quarters of the fruit, but presumably it regurgitates them in due course.

These birds have very definite flight lines between their roosting and feeding grounds every morning and evening. They stick to these year after year, and only vary them as different patches of

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jungle come into fruit. As a rule they fly in batches of anything from three or four to eight or ten birds at a time. They are generally only in range where the lines cross the top of a hill, and if shot at too much they will come over much too high to be touched. These flight lines are often some miles in length. The birds start to flight in to feed soon after dawn and go out to roost again about 9 a.m., repeating the performance again in the evening between 4 p.m. and dusk. They have exceedingly good eyesight and will spot a gun or any movement from a long way off, when they will immediately zoom upwards and pass over well out of range. Absolute stillness and some sort of protective hide are essential for a successful shoot.

In the S.W. monsoon most of the birds from the Grass Hills come down to lower levels, but they nest all over the hills in patches of sholah from March to May. By the second week in May most of the young birds are on the wing. The peculiar acrobatic soar and dive which is supposed to be a mating display can be seen at any time of the year. I saw some birds performing in late May this year after the nesting season was over, and I fancy it is just an expression of exuberance similar to the antics of tumbler pigeons.

These birds seem to prefer the highest trees they can find both for feeding and roosting, but I have twice put up Imperial Pigeons off the ground. On both occasions there were several young birds together which had apparently been resting on the ground under heavy jungle during the daytime. I do not think an old bird ever comes to earth except when brought there by a gun.

Nilgiri Wood Pigeon. [*Columba elphinstonii* (Sykes)].

This bird is common in the small sholahs on the Grass Hills but is only occasionally seen lower down. It sticks to the higher elevations all through the year. Some years ago I got into a camp late one evening on the Grass Hills and used an old derelict grass hut as shelter for the night. I was startled out of my sleep at dawn the next morning by about a dozen Nilgiri pigeons which unnoticed by me were already using the roof trusses as a roost when I got in, and had not been disturbed by my arrival. For a moment I thought the place was bewitched. A bilberry tree outside was providing their food.

Whistling Green Pigeon. [*Crocopus phoenicopterus chlorogaster* (Blyth.)].

These birds are migratory and are common all through our dryer months, sometimes in larger flocks. A few birds are occasionally seen during our rains but they never stop long in one place. They feed on small berries and figs of various kinds. I have never seen or heard any of these birds on the Grass Hills.

The plumage of the sexes is different. One bird which I believe to be the hen is a pale yellow green all over with a few dull bluish feathers. The other is much brighter coloured with very pretty yellow and reddy brown wing feathers.

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I have seen another and larger species of green pigeon in the deciduous bamboo forest of the foot hills near the Chinnar river at the foot of the Munnar-Udamalpet ghat. This bird was much larger, greyer in colour, and had a louder whistling call.

Bronze Wing Dove. [*Chalcophaps indica* (Linn.)].

These birds are common all over our hills. Unlike all our other pigeons, except the common dove, they are largely ground feeders. They are usually seen singly or in pairs strutting about the roadsides or in light undergrowth. They are very fast on the wing and very good eating when shot. Their favourite food in the planted area is the small seed of a quick growing secondary jungle tree whose Tamil name is *Wattagumy*. They sometimes perch in the tree itself but prefer to pick up the fallen seed off the ground.

They are migratory and leave us during the heavy rains but often reappear before the monsoon has quite finished. Their reappearance is a welcome indication that the monsoon is nearly over.

Although outside the subject of Game Birds it is of interest to record that there are no crows or jackals either in the Anamallai Tea District or in the Grass Hills this side of the Travancore boundary. An occasional crow is blown up here in a storm and several have been released by mischievous coolies at various times. They have hung about for a few days getting hoarser and hoarser and have then disappeared. There are plenty within a few miles at the foot of our ghat, and also throughout the jungle to the West around the timber depot of Mount Stewart. I have been told that there are jackals on the grass land in the High Range which is all part of the same stretch as our Grass Hills without any geographical bar to emigration. There are any number in the foot hills and low country to the North and West.

No one has ever satisfactorily explained these two mysteries. It is probable that there was nothing for either crows or jackals to feed on in the days when the whole area was dense and uninhabited evergreen forest but the Tea District has now been opened and well populated for a number of years.

(2) The Low Country area around Coimbatore, Pollachi, Udamalpet, and Kollengode, and the foot hills of the Anaimalai Hills

The shooting in the low country is either tank shooting or walking up snipe. Ground game are found in the foot hills.

Snipe are nowhere very plentiful, but with the help of a good shikari quite good shooting can be had. There is a large acreage of paddy round Anaimalai village to which quite a number of birds come, but they only frequent small patches at a time and are always moving their feeding grounds. Without the help of a shikari to do the advance spotting it is possible to walk all day and pick up very few birds. Similar shooting is to be had in the paddy round Coimbatore and Podanur. The paddy which is

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irrigated from the tanks round Udamalpet holds very few snipe and they are only to be found here in one or two small patches. The soil here is black cotton soil and it would seem that they do not care for it as a feeding ground.

Snipe are usually to be found round the margins of the tanks feeding in the morning and the evening but they leave these grounds between 9 a.m. and 4 p.m. probably on account of the cattle which graze there in the daytime. One or two of the river beds hold quite a number of snipe during the heat of the day. They lie up here in patches of screw pine and rushes, on islands in the stream, and under scrub on the banks. This shooting is hard work but good fun.

The birds arrive in late October or the beginning of November and stop until the end of March or the beginning of April.

Fantail Snipe. [*Capella gallinago* (Linn.)].

This is the commonest snipe throughout the area. Other snipe are comparatively rare. Fifteen couple between two or three guns shooting morning and evening is a good day's bag.

Pintail Snipe. [*Capella stenura* (Bonaparte)].

This snipe is uncommon and I have seen very few shot. When shot at they often leave the wet land and settle on the dry cultivation nearby.

Painted Snipe. [*Rostratula benghalensis* (Linn.)].

The Painted Snipe although not common is not the rarity that it seems to be in some places. It is not unusual to have several of these birds in the day's bag. They are generally found round the edges of the tanks late in the season in February and March. When put up they do not go very far before settling again and are slow on the wing, for which reason they are often missed. Contrary to the general belief they are quite good eating.

Ducks and other Tank Birds.

The duck shooting on the tanks at the foot of these hills used to be very good. In late April 1925, four guns had a bag of some 80 head in two hours' shooting. Since that time the shooting has got steadily worse, and at present a lot of local knowledge and cunning is necessary for even a poor bag. I don't think that the actual numbers of duck, except in the case of Cotton Teal, have fallen off very much but they get no rest and are much more difficult to get near. The increase of local guns is of course responsible. On most tanks guns can be heard every morning and evening. I had an object lesson from one of these gentlemen on how to shoot birds on the water. He stalked a bunch of five teal feeding at the edge of the tank. When he got within range he flattened himself out and fired his gun parallel to and just above the surface of the water getting four birds, all hit in the head, a much more effective method than trying to fire down on them.

Ducks on these tanks feed most of the night and are still feeding at dawn. If shot at between dawn and 8.30 they do not

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immediately clear off the tank. By 8.30 they have finished feeding and are resting on the open water. If shot at then they will probably clear straight off to a safer spot. On a dull and stormy day they will start to move again to their feeding grounds about 4 o'clock in the afternoon, but as a rule they do not move until just before dusk.

At Udamalpet there is a very big tank which is nearly all open water, with six or seven small tanks close to it. The big tank is a safe refuge when they are disturbed and for resting on during the day. They flight off to feed on the smaller tanks in the evening. The flight lines on and off the small tanks are always the same but the birds are by no means regular in their choice of tank for feeding. Duck start to arrive about the beginning of November, the first to come in being the Garganey Teal and the Spot Bill. They do not come in in any numbers until late November or December and they stay in spite of guns and drying tanks until late April. When they are getting ready to go they congregate in large numbers for a day or two in selected spots.

Garganey Teal. [*Querquedula querquedula* (Linn.)].

This is by far the commonest of our ducks and makes up about 75 per cent. of a day's bag. At one time Cotton Teal were about as numerous but their numbers have dwindled tremendously of recent years.

Common Teal. [*Nettion crecca crecca* (Linn.)].

This teal is very uncommon. The only one I have shot was a female in January 1936. I have seen one or two more.

Cotton Teal or **Pigmy Goose** (*Nettapus coromandelianus* Gemlin).

The Cotton Teal used to be as common as the Garganey a few years ago but its habit of hanging round the edges of tanks has caused its decimation by local guns of recent years. When shot at it will often take to stream beds and irrigation channels. It is the only one of our ducks that seems to do so.

Whistling Teal. [*Dendrocygna javanica* (Horsf.)].

Whistling Teal used to be fairly common but I have not seen one for some years.

Spot Bill Duck. (*Anas poecilorhyncha poecilorhyncha* Forster).

This duck used to be fairly common but seems to have decreased in numbers of recent years. It is the first of our big ducks to arrive in November.

Mallard. (*Anas platyrhyncha* Linn.).

Mallard are very rare. I have only seen one, and have heard of one other being seen.

Brahminy Duck. [*Casarca ferruginea* (Vroeg.)].

I have never seen one of these ducks but one was shot a year or two ago.

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Pintail. [*Dafila acuta* (Linn.)].

The Pintail is fairly common and seems to have increased in numbers in recent years.

Shoveller. [*Spatula clypeata* (Linn.)].

This duck is also fairly common particularly on the Udamalpet tanks. The prejudice against it as a table bird is unjustified.

One or two other ducks have been shot on shoots that I have at, but as I have been unable to identify them definitely I have not included them in this list.

Geese.

Until this season no goose had been recorded from the tanks in this area.

Last Christmas (1936) at a shoot on the Summatur tank near Pollachi we were surprised to see a solitary goose flying up and down the tank. We spent some time trying to get a shot at it but it never gave any of us a chance and eventually flew off following the river into the foot hills.

Some doubt was cast upon our tale, as is only natural, but having seen plenty of geese elsewhere I have no doubt on the subject. As far as it is possible to guess at its identity in the air it was probably a Bar Headed Goose. The appearance of the bird caused a sensation and much excitement amongst the local inhabitants some of whom were fishing for Murrel in the rushes just behind me. They had evidently never seen anything like it before.

Flamingoe. (*Phoenicopterus ruber* Linn.).

In March 1931 I shot a Flamingo on the small tank at Dhali near Udamalpet. Two of us were waiting on a flight line for teal and it got out of some tall rushes close to me when my companion fired his first shot. It was a young bird and is the only one I have seen or heard of here. The forest guard who ate it was very, very bilious afterwards.

White Ibis. [*Threskiornis melanocephalus* (Lath.)].

This season I shot a White Ibis, one of a pair on the Anamallai tank near Anamallai village in November. Unfortunately it was too far gone to sample on the table when I got home.

Black Ibis. [*Pseudibis papillosus* (Temm.)].

These birds are often seen hanging round any of the tanks in the area, generally in pairs. I am told that they are very good eating.

Pheasant-tailed Jackana. [*Hydrophasianus chirurgus* (Scop.)].

This season a pair of these curious birds were seen on the Vallyavutty tank near Udamalpet. The tank was almost dry and the birds were walking about in the shallow water.

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A PRELIMINARY ACCOUNT OF THE APHIDIDAE OF POONA

BY

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The aphididae of Poona are insects that have been very little collected and about which very little is known. The group, even in India as a whole, is very little studied. The lack of information is not, however due to any lack of importance. The aphids are widely known as one of the worst of agricuitural pests and, particularly so, on account of their excessive and rapid power of multiplication. The life of these insects is also very peculiar. There are dimorphic forms—alate and apterous—of which the apterous ones are the most important from the eceonomic point of view. The apterous females reproduce parthenogenetically and viviparously and thus their multiplication goes on by leaps and bounds. Some of these apterous females develop wings and reproduce their kind parthenogenetically and viviparously. The alate forms are principally concerned in the spread of infection from plant to plant while the intensity of damage depends upon the apterous colonies. The usual period of activity of aphids is from July to February; however, some species are found in the summer months also. The cold of winter appears to have no effect on their breeding and growth. There is no sexual generation observed in this part of India. Males are absent and no eggs have been noticed.

The damage done by the aphids is principally by the withdrawal of the sap from the shoots and leaves which consequently shrivel and wither. The aphids are very potential pests and if not checked in time a great deal of damage is done. They have been found to attack various crops—annuals and perennials. The citrus trees, as soon as the new shoots are thrown out in February and March are very seriously attacked, which results in checking the bearing. Mango shoots are observed sometimes to be full of aphids in February and March and a serious attack is bound to affect the bearing of fruits. Various vegetables and pulses are invariably attacked during the monsoon and afterwards. Betelvine, tobacco, cotton and chillies do not also escape the attack of aphids. In this way examples can be multiplied to show that aphids are a universal pest. Some species are specific pest of certain crops, while others are polyphagous and there are other species like *Myzus* sp. which is said to have about 35 different hosts. In short, considering the longer period of activity, their feeding habits, and the nature of damage caused by them, aphids occupy an important place among the major pests of agricultural crops and orchard trees and a complete knowledge of their life and behaviour is absolutely necessary both from the academic and economic points of view. The writer has been investigating the problem of control of the cabbage aphids and in the course of his studies he has collected aphids on different plants and vegetables in order to find out the alternate hosts. This collection was sent to Dr. P. W. Mason, Bureau of Entomology, Washington, D.C., U.S.A. for identification and the writer acknowledges with thanks the help rendered by him in this connection.

Though the aphids are an important pest, knowledge about their classification is very meagre. The only literature dealing with Indian species is *The Memoir of the Indian Museum* on 'The Aphididae of Lahore' by Das (1918). The identification received from Dr. Mason was generally useful in placing the species in their proper places, but it must be said that many of the identifications done by the writer agree with those given by Das.

Thanks are due to Dr. K. R. Karandikar, Ph.D. for going through the manuscript and making some useful suggestions.

The following is the preliminary account of the species collected by the writer during the last four years :—

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A. Tribe : **Callipterini**

(1) *Therioaphis ononidis* Kalt.

Young	...	Yellow and gray
Adult[1]	...	Gray
Pygidium	...	Gray
Cornicles	...	Dark

Host plant—Lucerne (*Medicago sativa*).

This species has been named by Das as *Callipterus trifolii* Monell. Lucerne appears to be the only host plant in the Deccan as the species has not been collected on any other leguminous plant. Both alate and apterous forms can be recognised by the pale yellow or gray colour and by the two rows of dusky spots on the back. The body with the dusky spots looks 'mouse like'. The attack is generally bad in summer months, but the insects have been observed in earlier months also. The anal plate is deeply bifid forming two long narrow lobes.

B. Tribe : **Aphidini**

I Sub-tribe : Macrosiphina

(2) *Myzus persicae* Sulz.

Adult	...	Greenish yellow
Young	...	Pale green
Pygidium	...	Greenish yellow
Cornicles	...	Dark (especiially in alate forms).

Host plants—Cabbage, radish, brinjals, potato, chillies, lettuce, shepu, etc.

This species is greenish yellow in colour, large in size and is easily recognised by the prominent pointed tubercles which are strongly converging, and the small cauda. The alate females have dark patches on the back. This is usually known as *radish aphis* as it appears at its earliest on this crop in the month of August from where it spreads to other plants.

(3) *Macrosiphum pisi* Kalt.

Adult	...	Green
Young	...	Green
Pygidium	...	Green
Cornicles	...	Yellowish green with the tips dark

Host plant—Sweet peas (*Pisum sativum*).

The genus *Macrosiphum* can be distinguished from the genus *Myzus* by the strongly diverging frontal tubercles and the elongate cauda. This species is invariably found on peas from October till February at Mahableshwar and in the plains. The aphis is large in size, green in colour and spindle-shaped in form, smooth in texture. The legs are green, the cauda and cornicles long. These aphids, especially the adults, fall down on the soil at the slightest touch, and are found on older leaves oftener than on young shoots.

(4) *Macrosiphum* sp.

Adult	...	Reddish brown
Young	...	Red
Pygidium	...	Red
Cornicles	...	Reddish brown.

Host plant—Shevanti (*Chrysanthemum* sp.).

This species has been identified by Dr. Mason as *Macrosiphonella sanborni*. It has been observed on the Chrysanthemum plants in October and is always confined to the young shoots which consequently get stunted.

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[1] The term Adult in this description refers to the apterous form.

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II. Sub-tribe : Aphidina

(5) *Siphocoryne indobrassicae* Das

Young	...	Yellow and green
Adult	...	Bluish green
Pygidium	...	Dark
Cornicles	...	Dark

Host plants—Cabbage, knolkhol, cauliflower, mogri (a kind of radish), turnips.

This species is invariably found on cabbage. The first appearance is in October, on seedlings, as soon as the cold weather sets in. It continues to breed till March when it disappears. It becomes a serious pest if not checked in time.

This species has been identified by Dr. Mason as *Rhopalosiphum pseudobrassicae* (Davis) Das (1) has discussed on page 173 of his *Memoir* the history of the names *Rhopalosiphum* and *Siphocoryne* and the characters of *Siphocoryne* given by Van der Goot and Das are as follows :—

(1) Frontal tubercles indistinct.
(2) Sensoria in the apterous females always absent.
(3) Cornicles clubbed in both—apterous and alate forms.

Those agree in the case of the species found in Poona and hence it has been put under *Siphocoryne*.

(6) *Siphocoryne avenae* Fabr.

Adult	...	(Winged) dark
Young	...	Not found
Cornicles	...	Dark brown

Host plant—Tobacco (*Nicotiana tabacum*).

This appears in Poona in the month of November. Only alate forms are found on leaves. Apterous forms and the young ones are not observed on plants.

(7) *Aphis sacchari* Zehut

Adult	...	Pink
Young	...	Almond yellow and pink
Pygidium	...	Black
Cornicles	...	Black

Host plants—Jowar, maize, bajri, rala, etc.

This species has been observed in Poona in the month of August on the underside of the leaves of maize and jowar. In the colonies are found insects of two different colours, whitish yellow and pink. These are attended on by large black ants. The black sooty mould grows profusely in the honey dew secreted by the insects and the leaves become dark in colour.

(8) *Aphis maidis* Fitch.

Young	...	Green or pale green
Pygidium	...	Greyish dark
Cornicles	...	Dark

Host plant—Jowar.

Along with the previous species this aphis is also observed on jowar shoots in August. This can be recognised by the colour, which is blue-green.

(9) *Aphis gossypii* Glover

Young	...	Yellow
Adult	...	Dark (Pupa—dark)
Pygidium	...	Dark
Cornicles	...	Dark

Host plants—Cotton, bhendi and hollyhock.

This aphis persists on cotton right from August to March. The yellow colour sometimes changes to greenish dark, hence there is ground for confusion about the proper identification, as this then resembles the next species.

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If the attack is very bad in the very early stage of the crop, the leaves curl and the crop shows signs of withering.

(10) *Aphis malvae* Koch

Young	...	Yellow, pale white
Adult	...	Alate dark, apterous—greenish dark
Pygidium	...	Dusky
Cornicles	...	Dark

Host plants—Cucumber, pumpkin, kohla, dodka, snake gourd, bottle gourd, parwar, tondali, karli, etc.

This species has been observed on these plants mainly in the monsoon and also on melons in the summer months. It is sometimes a serious pest and the crop suffers a great deal. The yellow colour of the young changes to dark green; and the alate forms are dark coloured.

(11) *Aphis medicaginis*, Koch

Young	...	Dark reddish brown
Adult	...	Reddish brown—full grown apterous adults with shining black spots on the back.
Pygidium	...	As the body colour—black
Cornicles	...	Black

Host plants—Wal, chavali, ghevda.

All the species collected on different leguminous crops were sent to Dr. Mason who identified them all as *Aphis rumicis*. The characters of *Aphis rumicis* given by Das and Theobald are :—

(1) Body dull black to dark greenish
(2) Post cornicular segments striped
(3) Forms pseudo galls

While those of *A. medicaginis*

(1) Body in the adult apterous female with a large shining black spot on back.

The colour, other characters, and particularly the habit of forming pseudo galls on leaves so characteristic of *A. rumicis*, are not noticed here and therefore *A. medicaginis* appears to be the correct identification. The chief characteristic of the apterous females consists in having a shining black spot on the back. Besides, the whitish patch on the femora and the tibia is also a special feature. Van der Goot proposes the name *A. papilionacearum* which has been accepted by Das.

This species is sometimes a serious pest of bean which suffers a serious set back in growth and bearing.

(1) *Aphis nerii* (Boyer de Fonscolombe).

Young	...	Deep yellow
Adult .	...	Yellow
Pygidium	...	Yellow
Cornicles	...	Dark

Host plant—Rui (*Calotropis gigantea*).

This species is most abundantly found on the veins and leaf stalks of Rui from August to February. All the lower leaves are covered with honey dew and the *capnodium* fungus growing on the secretion.

(13) *Aphis* sp.

Young	...	Reddish pink
Adult	...	Pink
Pygidium	...	Dark, conspicuously long
Cornicles	...	Dark brown

Host plant—Mango (*Mangifera indica*).

This species is found on young shoots and leaves of mango. This has been observed in November as well as in March. The alate form is pink in

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colour; antennae dark, legs pale white except at the femora and tarsi, cornicles and cauda dark. The apterous form pink in colour, thorax waxy white, antennae white except at the tips, cauda hirsute, cornicles dark, abdomen punctured laterally on both the sides.

(14) *Aphis* sp.

Young	...	Dark
Adult	...	Dark
Pygidium	...	Dark
Cornicles	...	Dark

Host plant—Safflower.

This species has been observed on safflower from November to January. This aphis is dark in colour and infests all shoots and leaves. The multiplication is very rapid and the honey dew secretion so profuse that the whole plant gets covered with the sticky substance and the numerous moults of the aphids.

(15) *Toxoptera aurantii* Koch.

Young	...	Deep yellow turning brown
Adult	...	Shining dark
Pygidium	...	Dark
Cornicles	...	Dark

Host plants—Mosambi, utaran, sour lime, grape fruit, jamburi, orange, etc.

All the species collected on different citrus plants have been identified by Dr. Mason as *Aphis citricidus*. This does not appear to be correct. The genus *Aphis* is distinguished from the genus *Toxoptera* by the branching of the *vein media* in the fore wing. In *Toxoptera* it is once-branched, while in *Aphis* it is twice-branched. The wing venation of the species found on citrus plants in the Deccan agrees with that of *Toxoptera* and not with *Aphis*. As to the specific name it appears to be a new one. Das states that *Toxoptera aurantii* is sparsely found on citrus plants in Lahore, but in the Bombay Presidency it is abundantly found. This has been noticed from September till March and attacks especially the young shoots.

This species is synonymous with *Ceylonia theacola* Buckton and has been mentioned in the *Indian Museum Notes*, vol. ii, No. 1 as occurring on tea bushes.

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SOME ADDITIONS TO THE FAUNA OF IRAQ.

By

Walter P. Kennedy.

(From the Royal College of Medicine, Baghdad, Iraq).

Between 1920 and 1922 a series of papers were published in this *Journal* on the fauna of Iraq and Persia. Excellent as this work was, it was not exhaustive, and some lacunae remained. So when in the course of certain other investigations a rather heterogeneous collection of specimens was gathered, it was thought that the interesting nature of the region justified publishing some notes, even though the information was only scanty. Some further indications might at least be given for other workers in the future.

MOLLUSCA

Diotocardia.

Neritina macrii Recluz. var. *minor*.
From Kani Tili in Kurdistan, 37° 11″N. 43° 38″E.

Monotocardia.

Melanopsis nodosa, Fer.
Several localities in immediate neighbourhood of Baghdad.

Basommatophora.

Limnaea tenera euphratica, Mousson.
Near Baghdad.
Bulinus truncatus, Aud.
Khan beni Saad, a village about 20 miles from Baghdad, incidentally heavily infected with Schistosomiasis.

Stylommatophora.

Xerophila vestalis, Parreyss.
Haruna, 36° 57″N. 44° 25″E.
Pomatia salomonica, Naegele.
Renji Brakha, 37° 06″N. 43° 54″E.

Cardiacea.

Cardium edule.
Lake near Kerbala.
Further notes on molluscs in Iraq will be found in a paper by Mills, MacHattie and Chadwick.

ARTHROPODA

Myriapoda.

Scolopendra morsitans.
Baquaba and Nasiriyah. Cases of poisoning are reported from this type.

Scorpionidea.

Buthus (*Prionurus*) *crassicauda*, Olivier.
Buthus australis, Hempr. & Ehr.
Buthus eupeus, C. L. Koch.

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Hemiscorpion lepturus, Peters.

B. crassicauda and *B. cupeus* are probably the commonest species of scorpions in Western Asia. They have been recorded from Afghanistan, Iran, Armenia, Syria and Arabia. *B. australis* was taken at Mandali where they are much feared as they are very toxic. *Hemiscorpion* (or *Hemiscorpius*) *lepturus* has been recorded much less frequently, and only from Baghdad and the southern parts of Iraq. I have obtained specimens from Mandali, and from Rowanduz and Sulimania in Kurdistan. Closely allied forms from Aden and Sokotra (Pocock, 1899), Muscat (Kraeplin, 1900) and E. Iran (Birula, 1903) have been described as separate species, but it seems likely that some or all of these are co-specific with *H. lepturus* of Peters. It is not a specially dangerous type. Death from scorpion stings are not unknown in Iraq, the victims being children or debilitated adults. Dohuk and Murgash, N. of Mosul; Sulimania in Kurdistan; and Mandali in Diala Liwa have evil reputations in respect of scorpions.

Solpugidæ.

Galeodellus (? species).

Galeodes ? bacilifer. Both from Asher near Basrah.

Galeodes arabs.

Specimens from Basrah, Nasiriyah, Baghdad, Baquaba in Iraq, and Isfahan in Iran. They are said to be venomous, and in Basrah and Isfahan at least, are feared. My bearer has frequently handled them freely and they have made no attempt to bite.

PISCES

Selachii.

Carcharias lamia, Risso.

This shark was taken in a fisherman's net just above Baghdad. Sharks are not frequent visitors so high up the Tigris as Baghdad, but isolated ones are heard of every year. In the river at Basrah they are more common.

Myliobatis aquila, L.

From the mouth of the Shatt-el-Arab. These eagle rays attain a very large size in the Persian Gulf.

Teleostii.

Barbus luteus, Heckel.
From Tigris about Baghdad, and also in small unnamed streams in Kurdistan.

Barbus kersin, Heckel.
Tigris, above Baghdad.

Barbus subquincunciatus, Günth.
Small stream at Rayy, near Teheran.

Discognathus rufus, Heckel.
Tigris at Baghdad.

Leuciscus (? species).
Tigris at Baghdad.

Girardinus faeciloides.
Exact provenance of this specimen unknown, but probably taken in the vicinity of Baghdad.

Aspius vorax, Heckel.
Tigris at Baghdad.

Alburnus mossulensis, Heckel.
Unnamed stream in E. Kurdistan.

Alburnus (? species).
Tigris at Baghdad.

Alburnoides (? *bipunctatus*, Bl.).
Small stream at Rayy, near Teheran.

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Mugil abu, Heckel.
Tigris at Amara and Baghdad.

Mugil dussumieri, Cuv. & Val.
Tigris at Amara and Baghdad.

Belone (? species).
Mouth of the Shatt-el-Arab near Fao.

Sparus berda, Forsk.
Tigris at Baghdad.

Mastacembelus (? species).
Tigris at Baghdad.

This list of fishes covers a small part of the total number, and further work is planned in this direction. It appears probable that there are two or three new species in the mullets, genus *Mugil*, and also a very great extention of range in one of the species which has hardly been recognised since the time of Forskal. There has been so little work done on the fish of this region that considerable difficulty is found in identifying the specimens. In addition to the above, representatives of *Hilsa*, and *Mystus* from Baghdad, and two species of *Varicorhinus* from Teheran and Kurdistan respectively have been tentatively identified.

AMPHIBIA

SALAMANDRIDÆ.

Triturus vittatus.
Newts are rare in Iraq. This is the only example which has been found so far as I can trace, and it only occurs in one spot,, a spring, Kuni Sheikh Omar near Berisa village in Kurdistan, 36° 56″N. 44° 17″E. I am indebted to Dr. Macfadyen for this observation.

BUFONIDÆ.

Bufo viridis.
Widely spread through Iraq.

HYLIDÆ.

Hyla arborea savignyi.
Baghdad and Amara.

RANINÆ.

Rana ridibunda.
Widely spread through Iraq.

Rana ridibunda susana.
N.W. Kurdistan.

Rana esculenta.
Baghdad.

Bufo viridis is distributed from the Pyrenees to the Thibetan Himalayas, and *Rana ridibunda* from Spain to Iran, and south to Egypt. Both species are probably divisible into a number of local races, especially in the eastern part of their range, but so little is known of them in these regions that it is difficult to assign them subspecific names.

REPTILIA

GECKONIDÆ.

Phyllodactylus elisae, Werner.
Three specimens of this rare gecko were reported by Procter in 1921 from the Persian frontier. The present example was found near Table Mountain near Baquba. It was thickly speckled with dark brown.

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AGAMIDÆ.

Agama persica, Blanf.
From Nasiriyah, being the most southernly record of this form. The specimen shows some differences from the typical Persian ones, but whether this indicates a subspecies difference it is not possible to determine from one specimen.

Agama agilis, Oliv.
From the Shia Khuh in the Salt Desert to the S.S.E. of Teheran, Iran.

Agama caucasica, Eichw.
Taken about 40 miles W. of Teheran.

Phrynocephalus scutellatus, Aud. (*oliveri*, Gray).
From the Shia Khuh, and also near Isfahan, Iran. At the latter a road running over a barren area had rocks and gravel on one side, and softer sandy soil on the other. *Phrynocephalus* was plentiful on the rocky side, but none were seen on the sandy side, where however, there were large numbers of *Mabuia septemtaeniata* (Fellow's skink). Neither type trespassed on the domain of the other, though separated only by a narrow road.

Uromastix loricatus, Blanf.
Porter, 1921, gives one specimen from Ruz as a new record for the country. The present specimen was brought to me by an Arab from a point he judged about 50 miles W. of Baghdad.

LACERTIDÆ.

Acanthodactylus fraseri, Boulenger.
This is, so far as I can discover, only the third known example of this species, described by Boulenger in this *Journal*, 1918. It was found at Nasiriyah.

Eremias brevirostris, Blanf.
Also from Nasiriyah, this specimen tends to show a link with *E. adramitana*.

Apathya (*Latastia*) *cappadocica urmicana*, Lantz & Suchow.
Two specimens one from the Jebel Hamrin, the other from the Rowanduz road in Kurdistan.

AMPHISBAENIDÆ.

Pachycalamus zarudyni, Nik.
This lizard was recorded by Boulenger in 1920, and it is noted again here on account of its distribution, and because it is uncommon. The specimen came from Abatia in the Southern Desert, 29° 33″N. 44° 53″E. So far as is known, no examples have been encountered near Baghdad or further north.

OPHIDIA

COLUBRIDÆ.

Lytorhynchus diadema, Dum & Bibr.
The Diademed Sand Snake is not a common snake in Iraq according to Corkill, who records three specimens from Shaiba, Falliyah, and Rutba. The present specimen was taken at Baba Gurgur, Kirkuk, by Mr. F. R. S. Henson, and thus extends the distribution of the species in this country.

Hydrophis lapemidoides, Gray.
From Bahrein Island in the Persian Gulf, and according to Malcolm Smith a rare species.

Lapemis curtus, Shaw.
Also from Bahrein Island. Smith records a specimen from Muscat, but I can find no reference to the occurrence of the type at the western end of the Gulf.

Microcephalophis gracilis, Shaw.
Brought up in a dredger bucket at Fao, mouth of the Shatt-el-arab.

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CHELONIA

TESTUDINÆ.

Clemmys caspica.

The common tortoise of Iraq: several specimens taken from all over the country.

TRIONYCHODEA.

Trionyx euphraticus.

Nasiriyah and the Tigris above Baghdad, the latter specimen measures 47 cms. in length, and I have seen some considerably larger. This mud tortoise has very powerful jaws, and is reputed to inflict destructive bites on men wading or swimming.

Some of these specimens were collected while I accompanied Mr. Henry Field during part of an expedition to the Near East organised by the Field Museum of Natural History, Chicago. Several types were found by Dr. Macfadyen. Many of the identifications were made by the authorities at the British Museum. To all of these thanks are due. The paper is published by permission of the Director General of Health, Baghdad.

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MARRIAGE FLIGHT AND COLONY FOUNDING OF THE COMMON BLACK ANT [*CAMPONOTUS* (*TANÆMYRMEX*) *COMPRESSUS* LATR.]

By

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(*With 2 text-figures*).

Introduction.

One of the commonest and most abundant of South Indian ants, the Common Black Ant, *Camponotus compressus* Latr., has been the object of observation and study by the writer for some time now; and an account of the same has been presented in a paper published in the *Bulletin of Entomological Research*, London, 1935 (vol. 25). In that paper the writer recorded the location, structure and contents of their abodes, their population and life economy, seasonal occurrence, associations and their agricultural importance together with a few facts in their life history and habits. There are still some very interesting problems such as their marriage flights, colony founding, etc., which have not hitherto received sufficient attention. Wheeler, one of the foremost among Myrmecologists, says that 'the date and form of marriage flight in ants are really specific characters and are clearly adaptations to the ecological conditions'. The writer intends in this brief note, to call attention to some peculiarities in the marriage flights, colony founding, etc., of this common species based on some recent observations.

Previous Knowledge.

Information of a most varied and interesting nature concerning the species has been published by various naturalists, but no satisfactory description of mating habits and other related phenomena has yet been furnished. Hence the evidence available on the nature of the association of the sexes and the manner of colony founding is practically non-existent. Rothney (1889) was probably the first to call attention to this habit of *C. compressus*. He merely states, however, that the sexes swarm in May or early June and take flight as soon as the sun goes down. According to Wroughton (1892) the marriage flight takes place in June after the first monsoon showers, usually in the evenings or in the night. Hingston (1923) records that he observed a number of sexual forms flying about the lamps indicating a nuptial flight. The present writer (1935) has written that the marriage flights have been observed in the evenings between 6.30 and 9 p.m. as the winged sexual forms are crepuscular. Further observations have led the

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writer to reconsider this question and revise his former statement in as much as he observed marriage flights occurring much earlier in the year, though the same might continue till June or even July.

MAIN FEATURES OF THE MARRIAGE FLIGHT OF *C. compressus*.

The data on mating habits and colony founding are greatly needed to throw light on the nature of association of sexes. As seen from the brief review presented above, previous investigators have not recorded any satisfactory description of the nuptial flight or copulation of this species. It is generally known that the marriage flights usually occur within definite and limited periods in the year, and the main factors that awaken the several forms to seek union on emergence from the nest are probably meteorological conditions. For over three or four years the writer has been watching colonies located permanently in certain places in order to see the initial stages of emergence of winged forms. Hundreds of times has he vainly sought to find them in the act of copulation. Times without number the writer has taken sexual forms attracted to light between May and June and rarely in July. He has also collected winged sexual forms in small numbers at other times particularly in October after the rains.

It was only in April this year that the writer was fortunate enough in witnessing the actual processes of emergence and mating. During the cool, humid afternoon of the 1st April 1936 at about half past one, the writer, in the course of a stroll in the back-yard garden of his house came upon a swarm of these ants. Many of the ants of the colony were not, at that time, out of doors. The day was particularly cloudy and there was slight drizzling with no sunshine at all from daybreak. A summary of the weather conditions as recorded in the institute for the day is furnished below.

Pressure.	Dry Bulb.	Wet bulb.	Maxm.	Minm.	Humidity.	Rainfall.
29·808	73·8	71·8	87·0F	70·6F	90	0·65

The ground was very wet as there had been heavy rains the previous evening and night. A small contingent of *C. compressus* was observed issuing from a formicary through an aperture near a masonry structure on the ground. A few large soldiers were the first to emerge and initiate the exodus. These were closely followed by a winged virgin queen with a train of other soldiers, workers of various grades and winged males. Their march around their old homestead was conspicuous in various ways. The throng looked like an unorganised and disorderly mass of workers of varying grades interspersed with winged sexual forms. The occasion seemed to be an extraordinary one since the whole company of workers was seething with excitement. They were moving restlessly about, passing and repassing their comrades. The virgin winged queen was also slowly wandering about with a peculiar jerky gait. On a detailed examination, the swarm was found to consist of one large winged virgin queen with a long and bulky abdomen, 29 winged males and 78 workers, made up of 40 large

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soldiers, 20 workers major, 10 workers media and 8 workers minor. The winged queen evidently happened to be the centre of attraction and the rest appeared to recognise the 'sanctity' of their charge as displayed by their extreme alertness. The workers, particularly the soldiers, never strayed beyond a small radius round about in the vicinity of the sexual winged forms.

For about a couple of minutes after emergence the males seemed to be utterly oblivious to the presence of the queen. By this time the queen was surrounded by a group of three to four males. There was no recourse to any kind of courting. The males simply crowded round her and each in its own way clumsily attempted to mount on her back. The queen's reaction was to move about with a view to avoid these overtures. At last one persistent male succeeded in its attempt and mounted on her back with its legs encircling her body. The male's abdomen was raised, the abdominal tip being bent and lowered on to the larger abdomen of the female and the connection was so effected. There was no attempt at flight throughout the act. It demonstrates that mating can take place on the ground near the nest. The actual process of copulation lasted for nearly two to three minutes; the queen then slowly slipped out and separated herself from the grip of the male. Within a minute after copulation she shed her large gauzy wings and converted herself into a dealated queen.

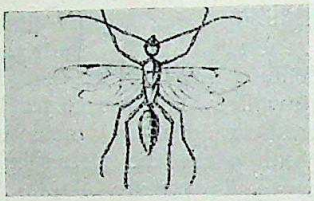

Fig. 1.—Winged male of the Common Black Ant (*Camponotus compressus* Latr.)

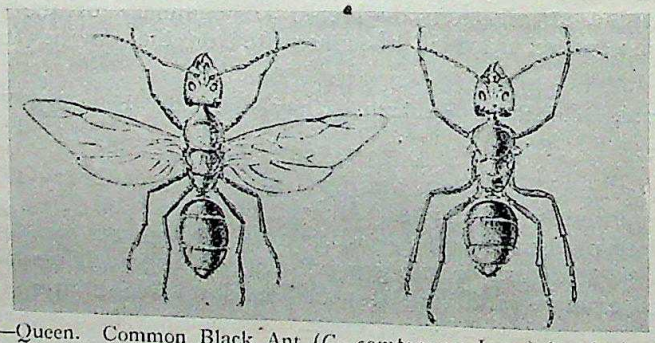

Fig. 2.—Queen. Common Black Ant (*C. compressus* Latr.) in virgin state and on shedding her wings after copulation.

The impregnated queen seemed to be taken extra care of by the workers. She was closely watched, followed and protected by the large soldiers. Attempts to capture the queen by the writer were greatly resented and were frustrated many times by the fierce fight put up by the excited and angry crowd. Every time, the ants rushed on the intruder furiously with open and outstretched mandibles, and inflicted severe bites, infusing the wound with a drop of formic acid from the abdominal extremity. Their watchfulness did not abate even after the queen had been imprisoned

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in a specimen tube. The tube was wrapped in tissue paper and laid nearby while the writer was engaged in watching other colonies. The fury of the retinue was directed to the tube and the wrapping was torn off to some extent and every attempt to liberate the royal prisoner were made. They remained in this highly excited and angry mood for very nearly half an hour and then slowly departed into the nest. But for a considerable length of time afterwards they continued to emerge again and again probably in their endeavour to make a vain search for their lost queen.

Colony founding.

A careful search of other nests in the locality showed that sexual forms had also emerged simultaneously in a few others. The number of sexual forms and the proportion of workers seemed, from a few rough computation, to vary within a wide range. In one case, probably after terrestrial mating, the soldiers with unlocked mandibles seized the wings of the fecundated queen and pulled them off violently. They later on virtually dragged her back into the parental nest. Two dealated queens attended by a large retinue of workers were observed in one case. A few other dealated queens were seen, accompanied by groups of workers at some distance from original nests and these had disappeared probably by migrating in a body to adjacent situations to start perhaps fresh branch colonies. There was not a single case of flight by the winged sexual forms. But at night, on the same date, the writer was successful in collecting a few winged forms which were attracted to ordinary lights. Evidently there had been an actual marriage flight.

These observations afford an insight into some interesting habits of *C. compressus* in regard to mating and colony founding. Terrestrial mating may occur just outside the parental nest and can take place early in an afternoon provided the environmental conditions are favourable. The queen thus fecundated has the option of either returning to the old homestead or of starting, by short migrations, a fresh branch-nest probably aided by her retinue of workers. As is evidenced by real marriage flights after dusk the sexual forms of different colonies in the locality have chances of mating on the wing, in which cases the fecundated queen can start fresh colonies almost unaided. It may also be inferred from the presence of more than one dealated queen in a fresh colony that a few fecundated queens may co-operate in founding fresh colonies. Evidence on this last method may be adduced from the following observation on a caged queen kept in the laboratory.

Life history notes.

From one of the swarms found emerging on the 1st April 1936 a virgin winged queen after impregnation on the ground outside the nest was from that date kept isolated in a small glass jar in company with the lucky male and a few workers of various grades. These were kept without any supply of food or even water. The queen divested herself of her wings in a few minutes. On the

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second day the male with the wings intact was found dead. The workers began to die one after another and by the tenth of the month there was no worker left alive. By this time the fecundated queen showed a slight distention of the gaster. Very little attention was paid to the cage because no supply of either food or water had to be made. On the 15th of the month the queen was found to have laid a first batch of five eggs. On the 16th eight more eggs were laid. These were carefully looked after by the queen mother; they were collected together, constantly licked and transported by her between her mandibles. On the 20th morning two of the eggs were noted to have hatched. The next day the two larvæ were observed to be of unequal size one being comparatively much larger than the other. The larvæ were also continuously fed on saliva, licked and groomed by the parent. On the 22nd of the month two more eggs hatched. The larger larva began cocooning between the smooth sides of the jar on the 24th. The other grub also commenced the process of spinning on the 27th. Meanwhile one or two more eggs had hatched. The cocooned specimens were very much undersized and these were carried by the mother to different parts of the jar. Though this time she attended to her own toilet, cleaning her antennae with her front legs and cleaning these in their turn by drawing them up between the maxillæ. By this time all the unhatched eggs and the small grubs were found missing having been consumed by the mother. On the 9th May 1936 a small worker adult was dragged out by the parent after cutting open the cocoon. It was yellowish white in colour to begin with, later on became brown and assumed the dark colour on the second day. The queen apparently looked healthy though languid and her bulk had gradually decreased. The queen eventually died on the 15th of the month and the other worker failed to emerge from the cocoon.

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DESCRIPTION OF A NEW SPECIES OF AGAMID LIZARD FROM UPPER BURMA.

By

MALCOLM SMITH, M.R.C.S.

[*From the Dept. of Zoology, British Museum (Natural History)*].

Japalura kaulbacki, sp. nov.

Type immature male, taken in the Nam Tamai Valley, Burma-Tibet border, at 3,500 feet altitude, by Mr. Ronald Kaulback, after whom I have pleasure in naming it.

Length of head one and a half times its breadth; snout longer than the orbit; forehead concave; canthus rostralis and supraciliary edge sharp; cheeks swollen; upper head shields unequal, keeled, the larger ones forming a ∧- shaped pattern on the forehead; occiput with spinose tubercles, namely an incomplete row parallel with the nuchal crest, and two or three more just above the tympanum, the diameter of which is one-third that of the orbit. Body compressed; dorsal scales unequal, moderately sized ones intermixed with much larger ones, the latter numerous and more strongly keeled, but not arranged in any regular pattern; the upper scales pointing upwards and backwards, the lower downwards and backwards; ventrals strongly keeled, smaller than the dorsals. A projecting fold of skin from behind the jaw to above the shoulder. Scales on the lower jaw and cheeks large, the largest as big as the large dorsals. No proper gular pouch, but a sharply defined triangular patch of skin covered with very small scales in its place. Nuchal crest low, composed of nine lanceolate scales; dorsal crest a mere ridge. Limbs rather weak, the hinder one reaching to beyond the ear; third and fourth toes equal. Tail swollen at the base, covered with large keeled scales, those of the median row above larger than the others and forming a denticulated ridge.

Colour in formalin: dark greyish brown, lighter below; gular patch blackish.

From snout to vent 70; tail 125 mm.

Japalura kaulbacki has affinities with *J. dymondi* and with the aberrant *Calotes kakhienensis*, from both of which it differs in the character of the gular scales, the enlarged dorsal scales, and in colour pattern.

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BUTTERFLIES AND MOTHS FROM CHINESE TURKESTAN.

BY

LT.-COL. J. W. THOMSON-GLOVER.

The material on which this list is based is not very extensive, and merely indicates how much work remains to be done. Much ground has not been visited at all, and places visited were only worked for a brief part of the Entomological season. A glance at Seitz's volumes which contain the results of the work of many Russian collectors will show how many species and varieties may be found in this Province.

Captain G. Sherriff while touring in connection with his Consular duties collected Butterflies in the Tekkes Valley and Tian Shan Mountains in 1928.

He also sent to Bombay a collection made in the Tekkes area in 1929. (Collected perhaps when the late Mr. F. Williamson, I.C.S., was on tour there.) Others from the Kaying Bashi Valley (some 70-80 miles south of Kashgar) in 1929, and lastly from Bostan Terrek. Specimens which reached Bombay in September and October 1930.

I also visited the Bostan Terek Valley which lies some 60 miles W.S.-W. of Kashgar for two weeks in August 1934 and again in July 1935. Moths were collected during 1934 and 1935 in the Consulate Garden, Kashgar, 4,320 ft. and Bostan Terek at 6,500 ft. and 7,500 ft. As a matter of interest I have included the *Lepidoptera* collected by Stolickza within the limits of the Province in 1873, 1874. These are shewn in brackets.

The Province adjoins Indian and Tibetan territory on the south; but the most noticeable feature is that the forms met with are almost entirely Palaearctic; the same is noticeable as regards birds and plants. As might be expected *vis a vis* India the types found are closest to those from the Shandur Pass in Chitral, and the Gilgit and Hunza Valleys. A list of those collected on the journey from Srinagar to Kashgar is appended. From Murkushi in Hunza until five stages from Kashgar no butterflies or moths were seen in October 1933.

The next most striking feature is the scarcity of butterflies found in the plains of the South from Karashahr to Kashgar and Yarkand. This may be due to the salt soil, and muddy water whereby suitable food plants and flowers are lacking.

The season for entomology is limited in the plains from April to September and in the hills the season is even shorter.

The most profitable area to search would certainly be the long range of Tian Shan Mountains nearly 1,000 miles from West to East and perhaps the Urumchi oases. These areas are also the richest in flora and fauna. The identification of many of the butterflies has been established through the help and kindness of

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the Bombay Natural History Society and of Brigadier W. H. Evans, these are marked with an asterisk.

In the arrangement of Families I have followed as far as possible that given in Seitz's volumes.

The list contains:—

Butterflies	...	...	...	65
Moths	...	...	...	70
				135

In addition I collected:—

Butterflies	...	...	...	2
Moths	...	...	...	38
Which have not been identified			...	40
				175

Butterflies collected from Srinagar to Kashgar via Gilgit:—

Butterflies	...	...	...	45
Moths	...	...	...	6
				51
Butterflies (not identified)		...	...	—
Moths (not identified)		...	...	26
				77

The following is a brief description of Sinkiang or 'The New Province' of China. The area comprises 445,000 square miles lying between latitude 36° and 45° and East longitude 75° and 94°.

The area sounds large but much of the centre is occupied by the dry and salt Tekla Makan Basin and Lop Nor with its marshes, the former comprises trackless deserts extending for miles while in other parts of the basin Tamarisk scrub and wild poplar are found, but even here there is little habitation or life as the water is brackish and supports chiefly horse-flies and mosquitoes.

Round the basin lie oases like Karashahr, Kuchar, Aksu, Kashgar, Yarkand and Khotan, wherein some 7,000 square miles only are cultivated at elevations from 2,000 ft. to 4,500 ft.; they depend for their existence on streams originating from the different ranges of hills, but before long these rivers disappear and are finally lost in the Great Desert of sand and none of them find their way to the sea.

The external boundaries are composed of high mountain ranges. Many peaks carry perpetual snow, the hills are frequently barren though those more favoured provide grazing for cattle and from 7,500 ft. to 9,000 ft. juniper and fir trees are found on the northern slopes.

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To the South and East are the Mustagh Range, Karakoram and Kuen Lun which form the chief boundary with India and Tibet, and the Province of Kansu.

On the west the Pamirs and Alai Ranges. To the north a portion of the Tian Shan. To the north-west the Ala Tau and further north the Tarbagatai Mountains. While the Atlai Mountains on the north-east border on outer Mongolia.

The main backbone of the Tian Shan separates the north of the Province including the districts of Barkul, Kucheng, Urumchi and Ili from the south.

From Urumchi westward the oases include grassy steppes and the climate is generally colder in the north with an increased rainfall in the summer.

Around Urumchi pheasant and partridge are found in ideal cover with flowering plants in the undergrowth.

The Sacred Mountains of Bogdo Ola which rise to a snow-covered peak of 20,000 ft. look most promising ground.

In the south the climate is dry with an annual rainfall in the plains of 3 inches.

The temperature varies from 110° in the summer to 15° in the winter approximating rather to the climate of Peking, while in the north in Urumchi the cold is much more severe and may be compared with that of Harbin and temperatures descend to 30° below zero in winter.

A. RHOPALOCERA : BUTTERFLIES

1. Family: PAPILIONIDÆ.

1. GENUS: PAPILIO.

* **P. machaon :** 8-9-28 Agiass 5,400 ft.; May-June 1929 Tekkes; 25-5-30 Kaying Bashi 11,500 ft.; August 1934 and July 1935 Bostan Terek. Not common but caterpillar found August hatched Kashgar on 22-6-35.

8. GENUS: PARNASSIUS.

* **P. apolo sibiricus :** 6-9-28 Oi Dunga (Tekkes) 6,500 ft.

* **P. discobolus :** May and June 1929 Tekkes.

* **P. actius :** 11-2-29 Kuen Lun Mts. 16,000 ft.; 14-8-34 Bostan Terek; 22-11-35 Bostan Terek. Common at foot of glacier 9,000-13,000 ft.

* **P. delphius :** May and June 1929 Tekkes.

* **P. delphius staudingeri :** July 1935 Bostan Terek 11,000-13,000 ft.

* **P. simo gylippos :** July 1935 Bostan Terek 11,000-12,500 ft.

* **P. loxias :** July 1935 Bostan Terek 11,000-13,000 ft.

2. Family: PIERIDÆ.

1. GENUS: APORIA.

* **A. crataegi :** May and June 1929 Tekkes.

2. GENUS: METAPORIA.

* **M. leucodice:** May and June 1929 Tekkes 18-8-29 Kaying Bashi 12,200 ft. Recd. 12-9-30 Bostan Terek, 5-8-34 Bostan Terek, July 1935 Bostan Terek. Very common in July; few in August.

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6. Genus: Pieris.

* **P. brassicæ**: 28-5-34 Kashgar. Common in plains June-September.

* **P. rapæ**: 5-9-28 Shotta 5,700 ft.; 30-8-29 Abad, 4,650 ft.; 8-9-28 Agiass 5,400 ft. Recd. 22-10-30 Bostan, 30-7-34 Kashgar, 6-8-34 Bostan Terek 6,000 ft. Common in plains June-September (Yangi Hissar April, Aktala May 17th).

* **P. napi**: May and June Tekkes.

7. Genus: Leucochloe.

* **L. daplidice**; 5-9-28 Shotta; 8-9-28 Agiass. Recd. 22-10-30 Bostan Terek, 14-8-34 Bostan Terek. Common 5,500-6,500 ft. (Sarikol May 2nd and 8th).

9. Genus: Synchloe.

* **S. callidice**: 22-9-28 Koksu 8,000 ft.; 13-9-28 Karajon 7,950 ft.; 17-8-29 Kaying Bashi 10,200 ft.; 15-8-34 Bostan Terek; end of July 1935 Bostan Terek (Raphani ?). Not common.

11. Genus: Euchloe.

* **E. chloridice**: 4-8-34 Bostan Terek; July 1935 Bostan Terek. Common 5,000-10,000 ft.

12. Genus: Anthocharis.

* **A. cardamines**: May and June 1929 Tekkes.

15. Genus: Baltia.

* (**B. shawii**: Aktagh north of Karakoram Pass 15,590 ft.)

20. Genus: Gonepteryx.

* **G. rhamni**: May and June 1929 Tekkes.

22. Genus: Colias.

* **C. cocandica**: 15-8-34 Bostan Terek; July 1935 Bostan Terek. Common 8,500-11,000 ft., but often difficult to catch grassy uplands. Settles on stones.

* **C. hyale**: 6-9-28 Tekkes; May and June 1929 Tekkes. Recd. 22-10-30 Bostan Terek 6,500 ft. The commonest butterfly in the plains Kashgar to Urumchi.

* '*var.* **pallida**: Recd. 12-9-30 Bostan Terek, 25-5-34 Kashgar, 14-8-34 (Sanju October 30th, Sarikol May 2nd, Yangi Hissar April).

* **C. romanovi ?**: 8-8-34 Bostan Terek 7,000 ft. Cell spot forewing, large insect: only one caught.

* **C. epgene**: Recd. 12-9-30 Bostan Terek, 15-8-34 Bostan Terek, July 1935. Common 9,000-10,000 ft.

23. Genus: Leptidice.

* **L. sinapis**: May and June 1929 Tekkes.

4. Family: Satyridæ.

12. Genus: Erebia.

* **E. mani**: Recd. 12-9-30 Bostan Terek, 25-7-35 Bostan Terek 7,000-11,000 ft. An active insect often difficult to catch.

14. Genus: Oeneis.

* '**O. hora verdanda**': May and June 1929 Tekkes.

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15. Genus: Satyrus.

* **S. (Erebia) turanica jucunda**: May and June 1929 Tekkes.

* **S. (Eumenis) briseis**: 5-9-28 Aksu Tekkes; 5-9-28 Shotta.

* **S. (Eumenis) heidenreichii**: Recd. 2-9-30 Bostan Terek, 6-8-34 Bostan Terek, July 1935 Bostan Terek. Very common 6,000-8,000 ft.

* **S. (Karanasa) geyeri**: Recd. 12-9-30 Bostan Terek, 10-8-34 Bostan Terek 7,000-8,000 ft. None met with July 1935. Some approach Regeli Alpherakyi, Huebneri, ground light yellow.

* **S. (Karanasa) huebneri**: 6-9-28 Tekkes.

* **S. (Eumenis) mniszechii (baldiva)?**: Recd. 12-9-30 Bostan Terek, 10-8-34 Bostan Terek, July 1935 Bostan Terek. Common 6,000-7,500 ft.

19. Genus: Epinephele.

* **E. narica**: 4-8-34 Bostan Terek; July 1935 Bostan Terek 6,000-7,000 ft.

E. naricina: 16-8-34 Bostan Terek 6,000-7,000 ft.

E. hilaris: But deeper red. 11-8-34 Bostan Terek. Only found in one place 9,000 ft. Not seen July 1935.

E. pulchella: 11-8-34 Bostan Terek.

20. Genus: Coenonympha.

* **C. pamphilus**: 6-9-28 Tekkes.

* **C. sunbecca**: Recd. 22-10-30 Bostan Terek, July 1935 Bostan Terek only! Specimen seen and caught.

6. Family: Nymphalidæ.

Subfamily: *Vanessinæ*.

Tribe. Vanessidi.

7. Genus: Pyrameis.

* **P. cardui (japonica?)**: 5-9-28 Khan Yailak 8,500 ft.; 7-9-28 Karajon 7,950 ft.; 23-10-33 Bostan Terek, Kasha Ka Su; 10-7-34 Kashgar; 6-8-34 Bostan Terek 6,000-7,000 ft.; 11-10-35 Kurla. Common in plains June to end of October (11-11-73 Karghalik, also at Sanju and south of Sanju).

8. Genus: Vanessa.

* **V. urticae rizana**: 13-9-28 Karajon 7,950 ft.; 5-9-28 Khan Yailak 8,500 ft.; August 1934 Bostan Terek; July 1935 Bostan Terek. Not numerous. Caterpillars found (U. Ladakensis 11-10-73, Karatagh Lake on snow mid-day temperature 33°).

* **V. antiopa yadanula**: 5-9-28 Shotta 5,700 ft.; May and June 1929 Tekkes.

9. Genus: Polygonia.

P. egea interposita?: 20-10-35 Urumchi 3,000-4,500 ft. Common end October and early November, in Pheasant covers around Urumchi. Not caught, identification uncertain.

Tribe: Argynnidi.

12. Genus: Melitaea.

* **M. saxatilis**: Recd. 12-9-30 Bostan Terek.

* **M. didyma ala**; May and June 1929 Tekkes.

14. Genus: Argynnis.

* **A. hegemone**: 5-9-28 Khan Yailak; May and June 1929 Tekkes. Recd. 12-9-30 Bostan Terek, August 1934 Bostan Terek, July 1935 Bostan Terek.

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* **A. pales : (isis or koria ?)** May and June 1929. Recd. 12-9-30 Bostan Terek, 11-8-34 Bostan Terek, 20-7-35 Bostan Terek 10,000-12,000 ft. Fairly common.

* **A. lathonia isæa :** 5-9-28 Khan Yailak 8,500 ft.; 8-9-28 Agiass; May and June 1929 Tekkes.

* **A. aglaia :** July 1935 Bostan Terek.

* **A. niobe :** May and June 1929 Tekkes.

* **A. adippe tianchanica :** 5-9-28 Khan Yailak; 10-8-29 Kaying Bashi 10,200 ft.; 12-9-30 Bostan Terek; 15-8-34 Bostan Terek; 20-7-35 Bostan Terek. Common 8,000-10,000 ft.

Argynnis sp.: Size and appearance of *sakontala*. Only 2 seen, chased for an hour on thistles in stony nullah 6,500 ft. August 1934.

7. Family: Erycinidæ.

4. Genus: Polycaena.

* **P. famerlana :** 16-7-35 Bostan Terek 9,000-13,000 ft. Not very common.

8. Family: Lycænidæ.

22. Genus: Chrysophanus.

* **C. solskyi (fulminans ?) :** 12-9-30 Bostan Terek; 5-8-34 Bostan Terek; 19-7-35 Bostan Terek. Common 6,000-7,000 ft.

* **C. phœnicurus (margelanica ?) :** Recd. 12-9-30 Bostan Terek, 16-8-34 Bostan Terek, 19-7-35 Bostan Terek 6,000-7,000 ft.

34. Genus: Lycæna.

* **L. cleobis :** May and June 1929 Tekkes 5,400 ft.

* **L. cristophi :** July 1935 Bostan Terek 7,000 ft.

* **L. galathea :** May and June Tekkes.

* **L. (Polyommatus) orbitulus :** 15-8-34 Bostan Terek; July 1935 Bostan Terek 9,000-10,000 ft. Markings heavier than *astorica*, strongly marked spot within cell.

* **L. pheretiades :** Recd. 22-10-30 Bostan Terek; 15-8-34 Bostan Terek; 20-7-35 Bostan Terek 9,000-11,000 ft.

* **L. eros :** Recd. 12-9-30 Bostan Terek; August 1934 Bostan Terek; July 1935 Bostan Terek 6,500-8,000 ft.

* **L. icarus thetis :** 5-9-28 Khan Yailak; May and June 1929 Tekkes. Recd. 12-9-30 Bostan Terek, 15-8-34 Bostan Terek, 20-7-35 Bostan Terek. A smaller blue than found in the plains resembles *yarkandensis* (23-5-74 Yarkand).

* **L. icarus :** 25-5-34 Kashgar; 30-7-35 Kashgar. Common in the plains May-July. Resembles *kashgarensis* (*Polyommatus kashgarensis* April 1874 Yangi Hissar).

* **L. dveanica :** Recd. 12-9-30 Bostan Terek.

L. damone iphigenides ? : 9-8-34 Bostan Terek 8,000 ft.

GRYPOCERA

1. Family: Hesperiidæ.

Subfamily: *Hesperiinæ.*

14. Genus: Hesperia.

* **H. (Pyrgus) alpina :** 15-8-34 Bostan Terek; 17-7-35 Bostan Terek 9,000-11,500 ft. Common, smaller than Cashmirensis; colour violet brown rather than grey brown.

* **H. tessellum :** May and June 1929 Tekkes 5,400 ft.

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PHALAENAE : MOTHS

4. Family: ARCTIDÆ (*Lithosiinæ*).

69. GENUS: ARCTIA.

A. rueckbeili : 15-7-35 Bostan Terek 7,500 ft. On fir trees in day-time.

5. Family: LYMANTRIIDÆ.

5. GENUS: ORGYIA.

O. trigotephras prisca : 7-8-34 Bostan Terek 6,500 ft.; 27-6-36 Kashgar.

25. GENUS: EUPROCTIS.

E. karghalica : 8-6-34 Kashgar, very common. 7-7-35 Kashgar (25-9-74 Karghalik).

E. lactea ? : (29-5-74.)

13. Family: SATURNIIDÆ.

10. GENUS: NEORIS.

(N. stoliczkana) (shadulla) : (1870 Shadulla R. B. Shaw.)

16. Family: SPHINGIDÆ.

2. GENUS: HERSE.

H. convolvuli : 7-4-34 Kashgar. Common April-September.

36. GENUS: MACROGLOSSUM.

M. stellatarum : 3-11-33 Kashgar; 5-8-34 Bostan Terek. Common Kashgar garden.

38. GENUS: CELERIO.

C. centralasiæ : 7-5-34 Kashgar; 5-5-34 Kashgar. Common.

C. gallii : 1-6-35 hatched Kashgar from caterpillar, August 1934 ex-Bostan Terek.

C. zygophylli : 23-5-36 Kashgar.

17. Family: NOTODONTIDÆ.

5. GENUS: DICRANURA.

D. przewalskii : 18-5-34 Kashgar; 2-6-35 Kashgar.

33. GENUS: PTILOPHORA.

(P. kashgara : 3-3-74 Yangi Hissar.)

NOCTUIFORMES

1. Family: AGARISTIDÆ.

14. GENUS: ACRONICTA.

(A. karghalika : 29-5-74 Karghalik.)

20. GENUS: EUXOA.

E. fatidica : 23-7-35 Bostan Terek 7,500 ft.

E. segetum : (29-5-74 Karghalik.)

E. oberthuri : 12-6-34 Kashgar.

E. exclamationis serena : 18-5-34 Kashgar; 3-5-35 Kashgar.

E. issykula multicuspis ? 11-6-34 Kashgar.

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21. Genus: Rhyacia.

R. squalorum: 10-8-34 Bostan Terek.

R. (Agrotis) dichagyris despecta: 15-6-34 Kashgar; 7-8-34 Bostan Terek 6,500 ft. Specimen from Kashgar is larger and darker.

R. spælotis undulans: 2-6-74 Akmasjid; 5-6-74 Chiklik.

R. defuncta: 6-8-34 Bostan Terek 6,500 ft.

R. degniata defuncta: 2-8-36 Kashgar.

Subfamily: *Hadeninæ.*

1. Genus: Barathra.

B. brassicæ canescens: 18-5-34 Kashgar. (30-5-74 Karghalik.)

6. Genus: Polia.

P. furcula: 6-8-34 Bostan Terek 6,500 ft.

P. furca: 16-7-33 Bostan Terek 7,500 ft.

P. mista: 8-6-34 Kashgar.

P spiniaceæ kœchiini: 7-8-34 Bostan Terek 6,500 ft.

21. Genus: Cardepia.

C. irrisor: 18-5-34 Kashgar.

Subfamily: *Cucullianæ.*

4. Genus: Stenostigma.

S. curva: 15-7-35 Bostan Terek 7,500 ft. Pinkish tinge on grey of forewing.

50. Genus: Blepharidia.

B. grumi: 15-8-34 Bostan Terek 6,500 ft.

Subfamily: *Amphipyrinæ.*

3. Genus: Amphipyra.

A. tragopoginis turcomana: 10-8-34 Bostan Terek 6,500 ft.

71. Genus: Athetis.

A. congesta: 11-8-34 Bostan Terek 6,500 ft.

Subfamily: *Heliothidinæ.*

12. Genus: Heliothis.

H. dipsacea: 15-7-35 Bostan Terek 7,500 ft. (28-5-74 Posgam, April 1874 Yangsi Hissar).

H. obsoleta: 8-7-36 Kashgar.

H. fusca: 27-6-36 Kashgar.

Subfamily: *Erastriinæ.*

29. Genus: Eustrotia.

(**E. olivana-bankia argentula**: May 1874 Ak Masjid.)

37. Genus: Erastria.

E. trabealis: (—**sulphuralis**): 13-6-34 Kashgar. Common. (*sulphuralis* Yarkand).

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38. Genus: Tarache.

T. fructuosa: 17-5-34 Kashgar. (April 1874 Yangi Hissar.)

Subfamily: *Catocalinæ.*

2. Genus: Catocala.

C. puerpera orientalis: 20-6-34 Kashgar; 15-6-35 Kashgar. Common.

C. puerpera pudica: 28-6-34 Kashgar; 5-9-34 Kashgar; 14-8-34 Bostan Terek 6,500 ft. Common Kashgar.

C. remissa indecorata: 20-6-34 Kashgar; 15-6-35 Kashgar.

33. Genus: Clytie.

C. syriaca pallida: 2-6-35 Kashgar.

Subfamily: *Phytometrinæ.*

1. Genus: Caloplusia.

C. alaica: 21-7-35 Bostan Terek 11,000 ft. Day-time.

3. Genus: Syngrapha.

S. circumflexa: 12-8-34 Bostan Terek 6,500 ft.

4. Genus: Phytometra.

P. confusa (gutta): 8-5-34 Kashgar; 31-8-34 Kashgar. Common.

P. Festuca (festata) 9-7-36 Kashgar.

Subfamily: *Noctuinæ.*

20. Genus: Apopestes.

A. spectrum centralasiae: 5-10-35 Maralbashi.

(**A phantasma:** 12-11-73 Yarkand.)

21. Genus: Autophila.

A. cataphanes: 7-4-34 Kashgar; 7-8-34 Kashgar; 5-10-35 Maralbashi.

A. cataphanes subligaminosa: 7-8-34 Bostan Terek.

58. Genus: Aleucantis.

A. catocalis: 15-7-35 Bostan Terek 11,000 ft. Day-time.

A. saisani: 7-8-34 Bostan Terek 6,500 ft.

A. caucasica: 27-5-34 Kashgar.

A. hyblaeoides: 15-5-34 Kashgar. (3-6-74 Chiklik.)

A. aksuensis: 8-7-36 Kashgar.

OXICESTA

(**O. marmorea:** 16-5-74 Sasak Taka.)

TAENIOCAMPA

(**— semiophora**) **chiklika:** (6-6-74 Chiklik).

GEOMETRAE

3. Subfamily: Hemitheinæ.

28. Genus: Euchloris.

E. prasinaira: 7-8-34 Bostan Terek 6,500 ft.; 20-7-35 Bostan Terek 7,500 ft.

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31. HEMISTOLA.

H. dispartita—Geometra dispartita—Nemoria dispartita : 31-5-74 Bostan Terek.

4. Subfamily: *Acidaliinæ.*

12. GENUS: ACIDALIA.

A. cumulata : 25-7-35 Bostan Terek 7,500 ft.

5. Subfamily: *Larentiinæ.*

47. GENUS: PHOTOSCOTOSIA.

P. oberthuri : 15-8-34 Bostan Terek 6,500 ft.

59. GENUS: CIDARIA.

C. distincta : 18-7-35 Bostan Terek 7,500 ft.

C. (—supethecia) truncata (—caturata) : 3-6-74 Chiklik.

6. Subfamily: *Geometrinæ.*

62. GENUS: OURAPTERYX.

O. ebuleata : 1-6-35 Kashgar; 20-7-35 Bostan Terek 7,500 ft.

137. GENUS: GNOPHOS.

G. ambiguata : 6-8-34 Bostan Terek 6,500 ft.

G. stolickzaria : (2-6-74 Ak Masjid).

G. tarentidae : 15-7-35 Bostan Terek.

G. thera kashgara : 3-6-74 Chiklik 14,480 ft.

Family: SCOPARIDÆ.

GENUS: EUDOREA.

E. granitalis : (6-6-74 Chiklik).

E. transversalis : (18-5-74 Igiz Yar 5,600 ft.) (April 1874 Yangi Hissar 1,320 ft.).

PYRALES.

BOTYDÆ.

BOTYS.

B. flavalis : (April 1874 Yangi Hissar; 2-5-74 Sarikol; 28-5-74 Posgam).

CRAMBICES.

PHYCIDÆ.

HOMOEOSOMA.

H. venosella : (2-6-74 Ak Masjid 8,870 ft.).

MYELOIS.

M. undulosella : (17-5-34 Aktala 7,342 ft.; 2-6-74 Ak Masjid 8,870 ft.).

M. griseella : (5-6-74 S.-E. of Chiklik).

TORTRICES.

CONCHYLIS.

C. stolickzana : (5-6-74 S.-E. Chiklik).

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TINEINES.

GELECHIDÆ.

DEPRESSARIA.

D. stigmella : (3-3-74 Yangi Hissar).

RHOPALOCERA : BUTTERFLIES

Srinagar to Border of Sinkiang

1. Family: PAPILIONIDÆ.

8. GENUS: PARNASSIUS.

P. epaphus cashmirensis : 15-9-33 Burzil 15,000 ft.

P. delphius rileyi ? : 15-9-33 Burzil 15,000 ft.

P. charltonius : 15-9-33 Burzil 15,000 ft.

6. GENUS: PIERIS.

P. brassicæ : 20-9-33 Bunji.

P. canidia : 11-9-33 Tragbal.

P. rapæ : 20-9-33 Bunji.

7. GENUS: LEUCOCHLOE.

L. daplidice : 28-9-33 Nomal.

22. GENUS: COLIAS.

C. hyale : 19-9-33 Poshwari.

C. croceus (edusina) : 14-9-33 Burzil Chowki.

3. Family: DANAIDÆ.

1. GENUS: DANAIS.

D. chrysippus : 25-9-33 Gilgit.

D. limniace : 27-9-33 Gilgit.

4. Family: SATYRIDÆ.

15. GENUS: SATYRUS.

S. saraswati : 10-9-33 Tragbal.

S. padma : 10-9-33 Tragbal.

S. anthe enervata : 17-9-33 Astor.

S. telephassa : 19-9-33 Doyan.

S. parisatis : 29-9-33 Chalt.

17. GENUS: PARARGE.

P. maera schakra : 10-9-33 Tragbal.

P. menava : 18-9-33 Dashkan.

19. GENUS: EPINEPHELE.

E. pulchella : 16-9-33 Gudai.

E. pulchella neoza ? : 29-9-33 Chalt.

E. davendra (chitralica) : 29-9-33 Chalt.

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6. Family: Nymphalidæ.

7. Genus: Pyrameis.

P. cardui: 29-9-33 Chalt.

8. Genus: Vanessa.

V. urticae: 10-9-33 Tragbal.
V. cashmirensis: 11-9-33 Tragbal.
V. xanthomelas: 11-9-33 Tragbal. 16-9-33 Gudai.

9. Genus: Polygonia.

P. egea interposita: 11-9-33 Tragbal. 29-9-33 Chalt.

Family: Argynnidæ.

14. Genus: Argynnis.

A. pales sipora: 15-9-33 Burzil.
A. adippe jainadeva: 15-9-33 Burzil.

8. Family: Lycænidæ.

18. Genus: Ilerda.

I. sena: 29-9-33 Chalt

22. Genus: Chrysophanus.

C. phleas: 13-9-33 Gurais.
C. kasyapa: 14-9-33 Burzil Chowki.

26. Genus: Polyommatus.

P. bœticus: 12-9-33 Poshwari.

31. Genus: Zizera.

(Z. maha): 28-9-33 Nomal.
(Sizera ?): 20-9-33 Bunji.

34. Genus: Lycaena.

L. galathea (chitralica): 10-9-33 Tragbal.
L. orbitulus (astorica): 10-9-33 Tragbal.
L. omphisa: 10-9-33 Tragbal. 13-9-33 Tragbal.
L. stolickzana: 15-9-33 Burzil.
L. icarus: 10-9-33 Tragbal.
L. sarta; 15-9-33 Burzil.

35. Genus: Cyaniris.

C. argiolus coelestina: 10-9-33 Tragbal.

46. Genus: Chaetoprocta.

C. odata: 12-9-33 Poshwari.

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GRYPOCERA

1. Family: HESPERIDÆ.

SUB-FAMILY: HESPERIINÆ.

13. GENUS: CARCHARODUS.

C. alceae : 13-9-33 Kagarbal.

14. GENUS: HESPERIA.

H. cashmirensis : 15-9-33 Burzil.

39. GENUS: PARNARA.

P. mathias : 23-9-33 Gilgit.

PHALAENAE : MOTHS

4. Family: ARCTIIDÆ.

3. SUB-FAMILY: HYPSINÆ.

33. GENUS: UTETHEISA.

U. pulchella : 21-9-33 Safed Parri.

SUB-FAMILY: CALLIMORPHINÆ.

71. GENUS: CALLIMORPHA.

C. principalis : 16-9-33 Gudai.

13. Family: SATURNIDÆ.

10. GENUS: NEORIS.

N. stolickzana : 14-9-33 Burzil Chowki. Marking of *stolickzana*. Colour like *huttoni*.

Family: NOCTUIFORMES.

SUB-FAMILY: AMPHIPYRINÆ.

3. GENUS: AMPHIPYRA.

A. tragopoginis nigrescens 12-9-33 Poshwari.

Family: GEOMETRÆ.

5. SUB-FAMILY: LARENTIINÆ.

47. GENUS: PHOTOSCOTOSIA.

Ph. miniosata : 14-9-33 Gurais.

Ph. amplicata : 14-9-33 Gurais.

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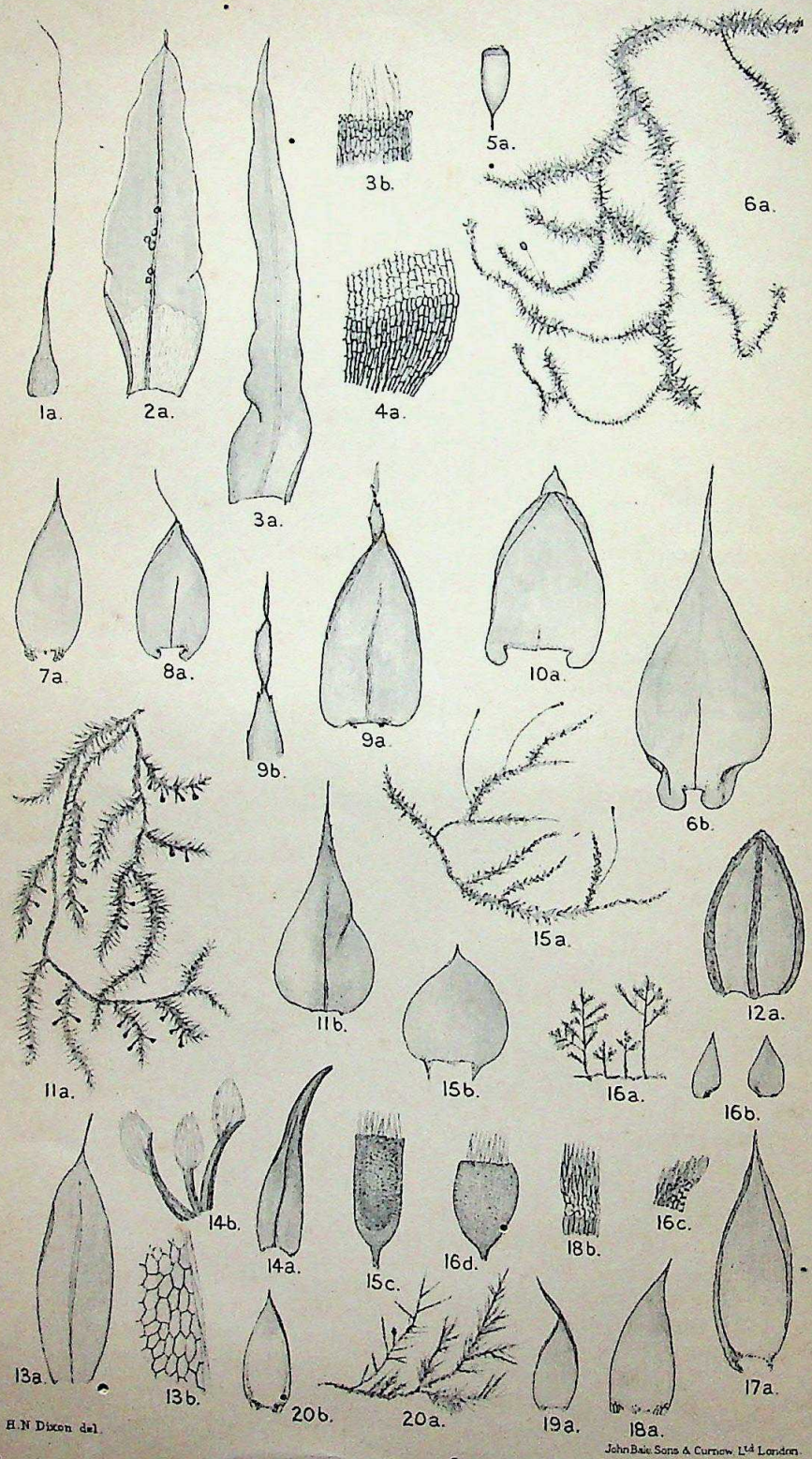

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ASSAM MOSSES.

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MOSSES COLLECTED IN ASSAM.

BY

H. N. DIXON, M.A., F.L.S.

(With a plate).

The following contribution to the bryology of Assam is based on collections made by Dr. N. L. Bor between 1933 and 1936.

Our main knowledge of the mosses of Assam is derived from the collections made by Griffith, published by himself and more completely worked out by Mitten in the *Musci Indiae orientalis*. In 1914 I published a 'Report on the Mosses of the Abor Expedition, 1911-12', in *Records of the Bot. Survey of India*, vi, pp. 57-73. With the exception of one or two scattered references to individual plants in literature this appears to exhaust our sources of information as to the bryology of this region. The present addition is therefore exceptionally welcome, the more so because the Assam flora is a specially interesting one, phytogeographically, and because the collections indicate a rich bryological flora—over 40 species new to science are included, and one new genus in addition to *Dendrocyathophorum* already described. Such genera as *Orthomniopsis, Jaegerinopsis, Lindigia, Handeliobryum, Hageniella, Leiodontium*, need only to be mentioned to indicate the exceptional interest of the collections.

The types of the new species are in my herbarium.

The topographical notes that follow have been kindly contributed by Dr. Bor.

The area in which a large part of these mosses were collected is known as the Balipara Frontier Tract: bounded on the south by the district of Darrang in Assam, to the north by Tibet, to the west by Bhutan, and to the east by the Sadiya Frontier Tract. The geographical limits are 94° 15″ and 92° 15″ East longitude, and 26° 45″ and 28° North latitude.

The area in the plains at the foot of the hills is directly administered by a Political Officer stationed at Charduar. The hills, however, are under the loose political control of the same officer who tours among the numerous tribes during the cold weather only, as the presence of numerous streams and rivers prevents access during the rains. The area is divided into two sections by the Bhorelli river which issues from the hills and flows into the Brahmaputra.

The area is of exceptional interest in that it has not, up to the present time, been explored botanically and it was not unexpected that many new plants would be found. During the writer's tenure of the post of Political Officer large collections of phanerogams have been made with the object of compiling a flora of the Aka Hills. That work will be produced by the *Botanical Survey of India* by the writer in collaboration with

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Mr. K. C. Biswas, M.A., at present curator of the herbarium in the Royal Botanic Gardens, Calcutta.

The hills are a jumbled mass of mountains, the general trend of the ridges being east and west, but there are numerous spurs, roughly north and south, from the main ridges.

The Aka Hills lie just to the west of the Bhorelli and are distinguished by a mountain, Piri, which reaches an altitude of 10,727 ft. To the east of the Bhorelli lie the Dafla Hills, the greatest elevation being 7,000 ft. The slopes are very steep and unstable and are prone to fall away in large slips.

Naturally little is known of the rainfall in the hills as the nearest rain gauge is 20 miles away in the plains. This gauge is at Charduar and records an average rainfall of 100 ins. To arrive at some idea of the rainfall in the hills four stations were selected on the Piri mountain. At each of these places kerosene tins each containing a film of oil were placed in May in trees out of the reach of elephants, and the contents were measured at the end of the rains.

The four stations selected were Doimara, 1,000 ft., Pestiferous Camp, 4,200 ft., Piri La, 9,500 ft. and Rupgya, 5,000 ft. The rainfall recorded from May to October was

Doimara 198 in.
Pestiferous Camp 210 in.
Piri La 246 in.
Rupgya 43 in.

Nothing was done in the Dafla Hills.

It will thus be seen that the southern face of the Piri mountain gets a much larger rainfall than that recorded elsewhere in the plains of Darrang and what is more, that the mountain practically gets all the rain there is. Rupgya is situated to the north of the Piri and gets a very small rainfall. The above figures, it will be observed, are only for a portion of the year and do not include the precipitation, known as the *chota bursat* which is often considerable, which falls in December and January. This precipitation takes the form of snow on Piri and in the valley beyond.

Frost is unknown in the plains but during the winter months the ground is frozen hard on Piri and snow lies on the northern slopes.

In April the weather is usually very dry and desiccating winds dry up the vegetation to the north of Piri and jungle fires are common. In the Dafla Hills which are clothed with evergreen forest and on the south side of Piri the undergrowth never dries up and jungle fires do not take place.

The monsoon approaching from the S.W. strikes Piri and deposits most of the rain on the southern face; only a small amount passes over into the Tenga valley.

Further to the east the monsoon sweeps up the Bhorelli gorge and over the Dafla Hills. The rainfall is everywhere high in this area and evergreen forest is predominant.

The geology of the ranges is interesting. The outer ranges are formed of the Lipam sandstones which explains at once their

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steepness and their tendency to slip. On the higher ranges Himalayan schist and granite are found and in the Tenga Valley limestone is common.

The vegetation in the Dafla Hills and on the southern face of the Piri is similar so far as equal altitudes are compared. Piri, of course, is much loftier and exhibits a distinctive vegetation of its own between 7,000 ft. and 10,000 ft.

With such a high rainfall and the continual mist on the hills it is to be expected that epiphytes such as lichens, mosses, orchids and the like flourish. The trees on the higher ranges are practically clothed with mosses and lichen, exceptions being those trees which shed their bark, such as the rhododendrons and conifers.

The shady valleys of the lower hills with their sandstone cliffs are favourite habitats of mosses. On the Piri at 10,727 ft. the soil is waterlogged for a considerable portion of the year and is covered with mosses, conspicuous among them being Sphagnum.

To give a detailed description of the flora of these hills would be out of place here: suffice it to say that the southern side of Piri is clothed with evergreen forest, the number of species decreasing as higher altitudes are reached. Oaks and maples make their appearance at 6,000 ft. and pass on upwards into rhododendron, hemlock and silver fir. The Tenga Valley with its low rainfall has a distinctive vegetation of its own. Oak and pine (*P. excelsa*) are predominant with poplar in the valleys. Cypress is confined to limestone.

The Naga Hills.

The Naga Hills district of Assam lies between the parallels 25° 2′ and 26° 47′ north latitude and 93° 17′ and 94° 52′ east longitude. To the north it is bounded by the district of Selsagar; on the south by the native state of Manipur; on the west by the north Cachar Hills, Nowgong and Selsagar, and to the east by a tract of mountainous country between Assam and Burma which is, for the most part, unexplored.

The district consists of a strip of country, the long axis of which runs N.E. and S.W. about 140 miles long and varying in width from 10-32 miles. Apart from a narrow border of plains on the N.W. the whole district consists of a series of ridges, roughly parallel to the long axis, of an average height of 5,000 ft. The main mountainous mass, however, is much higher and consists of two lofty ridges, averaging 8,000 ft., which join just south of Kohima (4,700 ft.), the headquarters of the district. The highest point is Japwo which is 9,898 ft. high. From Japwo the terrain falls steeply, almost vertical in places, but it is connected to the north with Pulebudza (7,000 ft.) by a ridge of the same average height as the latter. From Pulebudza the ridge falls steeply by Kohima.

In the Naga Hills all the slopes of the hills below 5,000 ft. are cultivated. The main ridge, therefore, has not been touched and is wooded to the summit, wherever the slopes are not too steep to carry forest. As is usual in hill forest the vegetation is zoned. From 5,000 ft. to 8,000 ft. the main species are oaks,

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birch, sycamores and species of Magnoliaceae forming a high forest of about 80 ft. Above 8,000 ft. rhododendrons and birch are the commonest trees. The canopy is rather open and the trees hardly reach 30 ft. Large stretches of Arundinaria are also common about 9,500 ft.

The rainfall at Kohima (4,700 ft.) reaches 70 in., the great bulk of which falls between the months of May and September. No data are available, or the amount of precipitation on the high ridges, but there is no doubt that it is far higher than that of Kohima. The high peaks of the main ridges are smothered in mist during the rains and very frequently during the cold weather. Frost is usual on Japwo during the cold weather, but snow is of comparatively rare occurrence. During the months of March and April, the climate is dry and fires have been known to occur on Japwo. These fires run through the mossy covering of the sandstone of which the ridges are composed. When the moss is burnt off the bare rock is exposed and the trees die, suggesting it is the mossy covering that conserves the water and enables them to exist.

At the higher elevations mosses and lichens are very conspicuous and long streamers of them hang from the branches and clothe the stems of the trees.

SPHAGNACEÆ.

Sphagnum acutifolioides Warnst.—In forest, above 3,000 m. alt., Piri, Aka Hills; October 1933 (9). In abundant fruit. Pseudopodia rather unusually long, generally a little above 1 cm.

FISSIDENTACEÆ.

Fissidens semperfalcatus Dix. (*Journ. Siam Soc., Nat. Hist. Suppl.*, x, 2). Moist soil, 150 m., Dharibati, Aka Hills; November 1934 (208). Elsewhere only known from Siam.

Fissidens rubricaulis Dix. sp. nov.

(Semilimbidium). Humicola. Sat robustus, dense caespitosus, laete viridis, caulibus vetustioribus rubris, 4-5 mm. longis, foliis plurijugis, eis caulium sterilium plumosis. Folia laxiuscula, sicca leniter flexuosa, e basi multo latiore oblongo-lanceolata, late acuta, haud acuminata; lamina vaginans perlata, valde aperta, supra medium folium attingens, limbidio sat bene evoluto, saepe supra laminam versus apicem folii producta. Costa apud basin validiuscula, superne angustata, concolor, infra apicem soluta. Lamina dorsalis ad basin costae vel paullo supra desinens. Margines integerrimi. Cellulae superiores per-distinctae, pellucidae, laevissimae, minutate, circa 6-7″ latae sat regulariter hexagonae, parietibus tenuibus. Folia caulis sterilis breviora, limbidio multo debiliore.

Dioicus. Seta 5-6 mm. Theca erecta, e collo distincto elliptica, sicca suburceolata; operculum rubrum, curvirostellatum; peristomium pallide rubrum, dentium crura spiraliter incrassata et papillosa. Spori saepe ovales, magna, 35-55 μ, laevissimi.

Hab. Balipara Frontier Tract, 100-300 m., November-December 1933 (55), type. Ibidem (58).

A very marked species, distinct among the Semilimbidia in the habit, the pellucid, smooth, minute cells, entire margin and large spores. The stems in the young state are pale, but when old become red, and are then from the lax arrangement of the leaves very conspicuous, recalling the African *F. purpureo-caulis* C.M.

Fissidens bryoides Hedw.—Piri, Aka Hills, 2,700 m.; November 1934 (253). Seta terminal, 1 cm., hence not *F. longisetus* Griff.

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Fissidens leptopelma Dix. sp. nov.

(Crispidium). Conferte gregarius, humicola, viridis. Caulis flabellatus, circa 5 mm. longus aeque ac latus. Folia 5-6 juga, madida complanata, sicca rigide falcato-decurva, circa 3 mm. longa, linearilanceolata, e medio folio angustata, peranguste acuminata, acuta. Lamina vaginans minusquam dimidiam partem folii aequans, ad marginem folii oblique desinens; lamina dorsalis ad basin folii sensim decrescens; omnes elimbatae, marginibus minutissime regulariter crenulatis. Costa sat angusta, pallida, concolor, summo apice soluta. Cellulae superiores minutae, hexagonae, dense alte unipapillosae; inferiores laxiores, pellucidae.

Dioicus. Flos ♂ terminalis, conspicuus. Seta terminalis, circa 1 cm., pallida, pertenuis (superne 50-60 μ lata), apice curvato, unde theca cernua vel horizontalis, perminuta, deoperculata circa .75 mm. longa; peristomii dentes longi, crura flexuosa, dense trabeculata, trabeculis intus alte lamellatis. Operculum haud visum.

Hab. Balipara Frontier Tract, 100-300 m.; November-December 1933 (42).

Quite distinct from any of its allies in the long and narrow, very longly and narrowly pointed leaves, as well as in the very attenuated seta.

Fissidens nobilis Griff.—On rock in deep shade, Balipara Frontier Tract 300 m., November 1934 (215). A form with the leaf point more acute than usual, less toothed, sometimes subentire.

Fissidens anomalus Mont.—Piri, Aka Hills, 2,500 m.; November 1934 (258b, 262b). c. fr.

Fissidens areolatus Griff.—Piri, Aka Hills; November 1934 (239, 240) c. fr. I have it also from Shillong, coll. Mrs. Stokoe, November 1912.

GRIMMIACEÆ.

Rhacomitrium javanicum Doz. & Molk.—Japwo, Naga Hills, 3,000 m., October, December 1935 (299, 341). c. fr.

DICRANACEÆ.

Trematodon assamicus Broth.—Charduar; 1934 (76). A fine plant with setae 3-4 cm. long, which agrees well with the description of Brotherus' species.

Garckea phascoides (Hook.) C.M.—Balipara Frontier Tract, circa 200 m.; November-December 1934 (64).

Ditrichum homomallum (Hedw.) Hampe.—Piri, Aka Hills, 2,300 m.; November 1934 (257). As far as I am aware, this species has not been recorded from Asia hitherto.

Ceratodon purpureus Hedw. var. **stenocarpus** (Bry. eur.)—Japwo, Naga Hills, 2,400 m.; October 1935 (316).

Microdus brasiliensis (Duby) Thér.—Shillong, 1,500 m.; September 1934 (168, 192).

Microdus assamicus Dix. sp. nov.

Humilis, caespitosus, soc. cum *Dicranella heteromalla* crescens; caules pauca mm. alti, foliis ad apicem agglomeratis, falcatis, e basi brevissima dilatata setaceis, 2.5-3 mm. longis, integerrimis nisi ad summum apicem saepe 2-3-denticulatis; costa tenuis, lata, male definita, subulam implens. Cellulae basilares laxisimae, hyalinae, late rectangulares, parietibus tenuissimis; supra basin raptim angustatae, angustissime lineares, a cellulis costae aegre distinguendae.

Seta tenuissima, pallidissima, valde flexuosa, saepe fere cygenea; theca minuta, pallida, deoperculata vix 1 mm. longa, ovalis, leptodermica, laevis; exothecii cellulae irregulares, fortiter incrassatae, parietibus valve curvatis; ad orificium rubrae. Peristomii dentes pallide rubri, e basi latiore saepe perforata aut integri aut plerumque in crura duo saepius inaequalia filiformia fissi, sat breves, haud striolati, apud basin tantum leniter trabeculati, supra integri, haud nodosi, laeves. Operculum haud visum.

Hab. Pankim La, Abor Hills, 300-2,900 m., 1934 (145).

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The position of this little moss is somewhat indeterminate; the peristome teeth are usually divided, as in Dicranella, but are small, irregular, and smooth, not striolate, as in Microdus, while the very flexuose, sometimes almost cygneous seta suggests an approach to Microcampylopus.

Dicranella heteromalla (Hedw.) Schimp.—In forest, 2,900-3,300 m., Piri, Aka Hills; October 1933 (24, 33). A rather marked form, which may be worthy of a varietal name. The leaves are very strongly serrulate, with short cells almost to the base; the base itself is short, and the basal cells short and wide. The fruit seems normal.

Dicranella divaricata (Mitt.) Jaeg.—Shillong, 1,500 m.; September 1934 (192 p. p.).

Dicranella leptoneura Dix. sp. nov.

Humilis; laxe caespitosa, lutescens. Caulis pauca mm. altus, sublaxifolius, saepe rufescens; folia divaricata, apicalia subsquarrosa, flexuosa, longiora; caulina circa 3 mm. apicalia circa 5 mm. longa, e basi latiore concava sensim in subulam longam flexuosam integerrimam angustata. Costa ad basin circa quartam latitudinem occupans, pertenuis, saepe vix distinguenda, superne subulam fere omnino implens, sectione 2-3-stratosa, e cellulis subaequalibus instructa. Cellulae omnes lineares, angustae, elongatae, basilares parum latiores. Planta ♂ similis, flore intense fusco, turgido, subgloboso. Planta ♂ et fructus valde juvenilis tantum visa.

Hab. Balipara Frontier Tract, 100-300 m., November-December 1933 (48).

In spite of the absence of mature fruit this may safely be pronounced distinct in view of the narrow, elongate cells throughout the leaf, and the extremely tenuous nerve, sometimes so thin in the basal part as scarcely to be distinguishable. The leaf subula is more attenuated than in *D. divaricata*.

Oreoweisia laxifolia (Hook.) Par.—Forest, 2,900-3,300 m., Piri, Aka Hills; October 1933 (40). Ibidem, 3,050 m., November 1934 (261e).

Symblepharis reinwardtii (Doz. & Molk.) Mitt.—In forest, Piri, Aka Hills; October 1933 (3, 20). Him Parbat, 2,000 m.; March 1934 (84). Pankim La, Abor Hills; 1934 (140). Japwo, Naga Hills, 2,700-3,00 m.; December 1935 (330).

Symblepharis helictophylla Mont.—Naga Hills; 1935 (270).

Dicranum lorifolium Mitt.—Japwo, Naga Hills, 2,750-3,000 m., December 1935 (331). I have several other gatherings from Assam in my herbarium.

Dicranum kashmirense Broth.—Pankim La, Abor Hills, 1934 (144).

Dicranum assamicum Dix. sp. nov.

(Pseudochorisodontium) Robustum. Caespites densi, nitentes; caules ad 8 cm. alti, regulariter foliosi; folia falcata, homomalla, supra argute dentata, eis *D. scoparii* subsimilia, sed tenuiora, vix chlorophyllosa; costa multo tenuiore, cellulis minoribus, pellucidis, parietibus ubique valde porosis.

Perichaetia cylindrica, bracteis internis convolutis, apice rotundato, abrupte cuspidato vel breviter aristato. Seta circa 2 cm. alta. Theca majuscula, erecta, symmetrica, aequalis, fusca, cylindrico-fusiformis, laevis. Opereum; paullo brevius, rectum. Peristomium magnum, bene evolutum, purpureum; dentes pallo irregulares, laeves, subpellucidi, fortiter lamellati. Spori variabiles, usque ad μ. 35

Hab. Japwo, Naga Hills, 2,750-3,000 m.; 7 December 1935 (333).

D. himalayanum Mitt. has the leaves entire, the peristome papillose; the teeth here are almost entirely smooth (I have seen faint traces of vertical striolation in the upper part of one or two).

Brothera leana (Sull.) C.M.—Shillong, 1,850 m.; September 1934 (184 p.p.). With dense apical tufts of small brownish brood-bodies.

Brothera capillifolia Dix. sp nov. (Plate I, fig. 1).

Multo laxiore et elatiore quam *B. Leana*; caules 2 cm. alti, laxiuscule, saepe interrupte foliosi; inferne radiculis albidis intertexti. Folia sericea, patentia, falcata, valde decidua, e basi perbrevi, perpellucida, convoluto-concava, dimorpha; aut subsensim in subulam setaceam plusminusve argute conferte denticulatam, aut abrupte in subulam longissimam (duplo fere longam) tenuis-

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simam, capillaceam, integram vel subintegram angustata. Cellulae basilares laxissimae, magnae, parietibus tenuibus, ad margines multo angustiores, supra perangustae, parvae, pellucidae, elongatae. Costa ad basin perlata, spongiosa, e stratis 3-4 cellularum inanium, pellucidarum, magnarum, parietibus pertenuibus instructa, superne angustata, male definita, e cellulis angustissimis composita.

Hab. In forest, 2,900-3,000 m., Piri, Aka Hills; October 1933 (5).

Possibly the type of a new genus, but sufficiently near *B. Leana* in the nerve structure, particularly in the lower part of the leaf, to be placed there, at least temporarily. The foliation is peculiar, the normal cauline leaves appear to be comparatively short, setaceous, but not very longly so (3-4 mm.), chlorophyllose, and frequently closely denticulate to near the base; at certain points on the stem the leaves, densely crowded, are entirely different, less or not chlorophyllose, deciduous, entire, very rapidly narrowed from the base to a much longer, much finer, entire, capillary subula; these may attain to even 1 cm. in length. The leaf base is minute, spongy, so concave as to appear when detached almost solid and bulbiform, pale, slightly reddened at the line of insertion.

Campylopus lætus (Mitt.) Jaeg.—Shillong, 1,800 m., September 1934 (191).

Dicranodontium dimorphum Mitt.—Piri, Aka Hills, 3,000 m.; November 1934 (261d). Naga Hills; 1935 (274). Japwo, Naga Hills; 2,750-3,000 m., December 1935 (342) c. fr.

Several of the Indian species described by Mitten are difficult to separate from one another, the fruit even when present does not always give much assistance. No. 261 has the subula more toothed than usual, but in other respects seems to agree. No. 274 is a rather marked plant, having conspicuous purple auricles, and a strong nerve; it is a much more robust plant than *D. didymodon* (Mitt.) and *D. caespitosum* (Mitt.). An unpublished Himalayan species of Brotherus has equally conspicuous auricles, but has a flat subula and very much narrower nerve. No. 342 is in fruit in nice condition; I believe the fruit has not been recorded. The seta is about 1 cm. high, very thin, pale, when dry erect and flexuose, the capsule small, dark, erect, elliptic from a tapering base, symmetric, smooth, the lid straight, rather shorter than the capsule.

Dicranodontium asperulum (Mitt.) Broth.—Naga Hills; 1935 (269). A form with remarkably white leaf bases, as well as white tomentum.

Dicranodontium decipiens (Mitt.)—Cheswezuma, Naga Hills, 2,100 m.; December 1935 (324). A difficult plant. It appears to belong to Dicranodontium. Reimers issued it in Max Fleischer, M. Fr. Archip. Ind. et Polyn., No. 561, as 'Dicranodontium decipiens (Mitt.) Mitt.', but I have been unable to trace the publication where Mitten placed it under the present genus.

LEUCOBRYACEÆ.

Leucobryum javense (Brid.) Mitt.—Kanjara, Naga Hills, 2,000 m.; November 1935 (363).

Leucobryum bowringii Mitt. var. sericeum (Broth.) Dix.—Pestiferous Camp, 1,200 m., Piri, Aka Hills; November 1934 (227). The nerve is almost homostrosic, only a single cell here and there, both dorsal and ventral, being transversely divided, very near the base of the leaf.

Leucophanes octoblepharoides Brid.—Balipara Frontier Tract; November-December 1933 (63).

Octoblepharum albidum Hedw.—Near Charduar: 1934 (154).

Exodictyoa blumii (C.M.) Fleisch.—Forest, 3,000-3,300 m., Piri, Aka Hills; October 1933 (21b). New to Northern India. Distr. Java; Philippines; Borneo; Malay Penins.

CALYMPERACEÆ.

Syrrhopodon pilulifer Dix. sp. nov. (Pl. I, fig. 2).

Thyridium. Corticola. Subrobustus, saturate olivaceo-viridis, ramis circa 3 mm. longis; folia sicca leniter rigide incurvo-hamata, 2.5-3 mm. longa, e

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basi brevi erecta vix latiore late oblongo-lanceolata, breviter acutata, latiuscule cuspidata, marginibus vix undulatis, integris vel subintegris; costa validiuscula, stricta, dorso laevis. Limbus cartilagineus inferne latus, usque ad 20-seriatus, sat longe infra apicem solutus. Cellulae perminutae, parietibus tenuibus, laevissimae. Cancellina brevis. lata, e cellulis parvis composita. Corpuscula parva, numerosa (circa 30-40 μ lata), sphaerica, pluricellularia, fusca, in pagina et costae ventri inveniuntur.

Seta circa 5 mm., theca minuta, erecta, vix nitida.

Hab. Balipara Frontier Tract, 100-300 m.; November-December 1933 (46).

The much broader, entire border, smooth cells, and absence of secund-leaved stoloniferous branches separate this from *S. flavus* and *S. Vriesei,* and (except for the last character) from *S. cuspidatus.*

The minute spherical bodies on the upper surface of the leaf appear to be of the nature of gemmae; if algoid there would be no reason for their being confined to this region of the leaf. Apical tufts of small, fusiform gemmae are also present at the tip of most leaves.

Calymperes burmense Hampe.—In forest, 3,000-3,300 m., Piri, Aka Hills; October 1933 (2). This agrees well with Hampe's type. It appears to be a rare species, only found hitherto in Burma.

Calymperes hampei Doz. & Molk.—Charduar; August 1934 (173).

POTTIACEÆ.

Trichostomum cylindricum Bruch—Pulebudze, 2,350 m., Naga Hills; August 1935 (294a). Japwo, circa 2,750 m., Naga Hills; December 1935 (330 p.p.). Both c. fr.

Pseudosymblepharis pallidens Dix. sp. nov. (Pl. I, fig. 3).

Gracilescens, elata, habitu *Symblepharidis helictophyllae* Mont. Folia laxiuscula, patentia, superne comosa; sicca crispata, 3-4 mm. longa, e basi erecta, subvaginante, sensim angustata, lineari-lanceolata, sensim anguste acuminata, acuta, marginibus planis, intergris seu crenulato-papillosis. Costa ad basin sat valida, superne attenuata, pellucida, infra apicem soluta. Cellulae superiores subquadratae, vel subrotundatae, distinctae, parietibus firmis, subincrassatis, papillosae, basilares longiores, breviter rectangulares, infimae paucae laxiores, pellucidae, parietibus tenuioribus.

Dioica. Folia perichaetialia caulins subsimilia.—Seta 1 cm., tenuis, erecta, pallida. Theca parva, cum operculo 3-5 mm. longa, anguste elliptica, paullo asymmetrica, operculum pallide tenuirostre, thecae longitudinem fere aequans, cellulis laxiusculis, seriebus rectis, haud obliquis. Annulus latus, persistens, sed facile dilabilis. Exothecii cellulae elongate rectangulari-hexagonae, parietibus tenuissimis. Spori parvi. Peristomium perpallidum, dentes ad basin cohaerentes, inde in crura divisa valde irregularia et inaequalia, saepe anastomosantia, vel ramificantia, vix nodosa, dense humiliter papillosa.

Hab. Japwo, Naga Hills, 2,450 m.; October 1935 (322).

The leaves are shorter and wider than in most of the species. They are very similar to those of *P. pervaginata* (Broth.) Broth., but much less dilated below.

Hyophila involuta (Hook.) Jaeg.—Several gatherings.

Barbula gregaria (Mitt.) Jaeg.—In forest, Piri, Aka Hills, 3,000-3,300 m.; October 1933 (11).

Barbula indica Brid.—One or two gatherings, on the lower ground.

ORTHOTRICHACEÆ.

Ptychomitrium rhacomitrioides Dix. sp. nov. (Pl. I, fig. 4).

Robustum, caespitosum; caules ad 8 cm. alti, erecti vel adscendentes, parce ramosi, interrupte foliosi, olivacei. Folia patenti-squarrosa, sicca fortiter crispata, magna, 5-6 mm. longa, e basi longa, lata, vaginante, plicata, subsensim in laminam recurvam, latam, canaliculatam, fortiter regulariter runcinatam subabrupte terminatam angustata. Costa inferne valida, supra angustior, cum apice evanida. Margines supra basin angustissime recurvi. Cellulae supremae subisodiametricae, seriatae, incrassatae, perdistinctae, parietibus leniter

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sinuosis; versus basin sensim elongatae, breviter rectangulares, parietibus valde sinuosis; inde multo longiores, 4-6 × 1, fortiter sinuosae, omnino Rhacomitrioideae; infimae abrupte mutatae, per totam latitudinem pulchre aurantiacae, laxae, magnae, 2-stratosae, inanes, parietibus rectis, tenuibus.

Autoicum. Fructus terminales, sed saepe ad annum sequentem persistentes, 2-5 aggregati; folia perichaetialia vix distincti; seta circa 8 mm. longa, erecta, pallida, ad basin et vaginluam rubra. Theca leptodermica, in collum defluens, operculata circa 4 mm. longa, cylindrica; operculum rectum, aciculare; calyptra straminea, nitida, basi laciniata leniter plicata. Peristomium generis, dentes aurantiaci, praelongi, crura stricte tenuissime capillaria, praealte, tenuissime papillosa. Spori minuti.

Hab. Japwo, Naga Hills, 2,750-3,000 m.; 7 December 1935 (343), type. Ibidem (330). Above Dharmsala, Punjab, India, circa 2,750 m.; 17 June 1929; coll. R. R. Stewart (10309A).

A very striking plant, especially in the remarkable areolation; the cells at insertion are a deep orange, at least 2-stratose; lax, thin-walled and pellucid, forming deep pseudo-auricles resembling those of Dicranum but reaching quite across the leaf; above these all the cells are absolutely Rhacomitrioid, and only in the part of the lamina above the base take on a more normal Ptychomitrioid form, but even then retaining, sometimes to the apex, traces of the sinuosity of the walls. The Himalayan plant was first seen, and I referred it without hesitation to Holomitrium, no calyptra being present, and the peristome being all more or less destroyed (It was this plant to which I referred in *Annales Bryology.*, vi, 21, as having a similar areolation to a new species of Symblepharis from Mt. Cameroon). The Ptychomitrioid calyptra of the Assam plant revealed its true position.

Zygodon brevisetus Wils.—Chingku, Naga Hills, 2,500 m.; November 1935 (354). Very near *Z. intermedius* Bry. eur., but apparently distinct.

Macromitrium nepalense (Hook. & Grev.) Schwaegrichen—Ngorruara, on dead log, 900 m., Naga Hills; November 1935 (349).

Macromitrium calymperoideum Mitt.—Balipara Frontier Tract, below 300 m.; November-December 1933 (49). Common on trees in plains, near Charduar; August 1934 (74, 178).

Macromitrium hamatum Dix. sp. nov.

Belongs to the group of Leiostoma having leaves with broad, strongly inflexed or hamate leaf apices, and smooth basal cells, to which *M. nepalense* and *M. assamicum* belong. It differs from these however in having the leaves not spirally twisted when dry, but strongly incurved and crispate. In this it is nearer to *M. calymperoideum*, which differs slightly but distinctly in the shorter, broader, more obtusely pointed leaves, with the cells short and very little altered to base. *M. inflexifolium* Dix. from Siam has quite different upper cells. The leaves here are longer and more tapering than in any of the allied species, widely but quite acutely pointed.

M. calymperoideo Mitt. affine. Differt foliis longioribus, angustioribus, ad apicem anguistatis, acutis vel apiculatis, cellulis basilaribus pellucidis, infimis, praecipue marginalibus elongatis, linearibus, juxtacostalibus paucis laxis, inanibus. Cellulae superiores minutae, 5-7 μ laeves vel humillime mamillosae. Calyptra pilosa. Fructus immaturus solum visus.

Hab. On tree trunk, 1,680 m., Pedi, Naga Hills; 1 August 1935 (284 bis).

Macromitrium rigbyanum Dix. sp. nov. (Pl. I, fig. 5).

Sat robustum. Rami variabiles, plerumque longiusculi, densifolii. Folia sicca valde crispata, angusta, lingulata, sensim anguste acuminata, acuta; costa cum apice soluta vel brevissime excurrens. Cellulae circa 8 μ distinctae, humiliter papillosae, marginales regulariter minute crenulatae, infra sensim elongatae, basilares lineares, angustae, laeves, paucae juxtacostales 'calymperoideae'. Bracteae prichaetii angust acuminatae, stricte breviter aristatae. Seta circa 6 mm. longa. Calyptra pilosa. Operculum aciculare. Theca e collo brevi breviter cylindrica, laevis, fusca, apud orem vix angustata, ibidem purpurea, subnitida, microstoma. Peristomium bene evolutum, e dentibus flavidis dense papillosis in membranam vel per paria plusminusve cohaerentibus instructum. Spori variabiles, magni, usque ad 27 μ

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Hab. Kurseong, Himalayas, 1926; coll. Fr. Rigby, comm. Rev. G. Foreau (592), type. Assam, Him. Parbat, 2,000 m., 21 March, 1934; coll. N. L. Bor (89). Ibidem, Peak, Charduar, 1,850 m.; 1934 (167). Pankim La, Abor Hills, 300-2,900 m.; 1934 (148). On rock, Dzulake, Naga Hills, 1,850 m.; 31 August 1934 (280 bis).

A very distinct plant, not in habit or leaf structure, but in the capsule. This is cylindrical or barrel shaped, scarcely tapering to the mouth but with a purplish cushion of much smaller, incrassate exothecial cells surrounding the mouth and extending for an appreciable distance down. It is similar to that of *M. bathydontum,* described by Cardot from Corea.

Maromitrium turgidum Dix.—Japwo, Naga Hills, 2,400 m.; October 1935 (303). Ibidem, 3,000 m.; November 1935 (310).

Nov. var. **laeve** Dix. Cellulae basilares laeves.

Dafla Hills, 1,200 m., March 1934 (90) Tako Senyak, 1,200 m.; March 1934 (113). Paora, Naga Hills, on tree trunk, 2,150 m., September 1935 (283 bis).

In the original plant from Siam the basal cells were more or less markedly tuberculate. As this is usually considered a crucial character, I have thought it best to describe the smooth-celled plant as a variety. The character is however not a constant one, as in one or two of the Assam gatherings I have found the basal cells indiscriminately smooth or tuberculate on the same specimen.

Macromitrium sulcatum Brid.—Japwo, Naga Hills, 2,750-3,000 m.; December 1935 (338).

Macromitrium ramentosum Mitt.—Tako Senyak, Dafla Hills, 1,200 m.; March 1934 (103). Hitherto only known from Ceylon.

Funariaceæ.

Funaria wallichii (Mitt.) Broth.—Shillong; September 1934 (200).

Funaria hygrometrica Hedw. (*F. leptopoda* Griff.)—Several gatherings.

Splachnaceæ.

Splachnobryum assamicum Dix. sp. nov.

S. Oorschotii forsan affine; multo gracilius, laxifolium, foliis siccis valde flexuosis, convolutis. Folia madida patula, 1.5 mm. longa, perconcava, saepe subconvoluta, e basi oblonga latiore sensim lingulata, plerumque rotundato-obtusa, marginibus planis vel recurvis, integerrimis. Costa tenuis, summo apice soluta. Rete perpellucidum, e cellulis parvis, rectangularibus, parietibus tenuissimis instructum. Cellulae superne sensim abbreviatae, irregulares, rhomboideo-hexagonae, ad apicem subisodiametricae.

Dioicum; planta ♂ femineae subsimilis, floribus axillaribus numerosis magnis, turgidis, antheridiis magnis, congestis. Seta circa 6 mm. longa, tenuissima, intense rubra. Theca minuta, 1 mm. longa, subcylindrica; peristomium haud visum.

Hab. On brickwork, Charduar, 2 August 1934 (176), type. On sandy soil, 700 m., Charduar; 13 July 1934 (162).

A strongly marked species in the narrow, lingulate leaves, deeply channelled, with nerve reaching close to the apex.

Tayloria indica Mitt.—Piri Camp, 2,300 m., Aka Hills; November 1934 (265). Naga Hills; 1935 (268, 284).

Tayloria subglabra (Griff.) Mitt.—Pulebudze, Naga Hills, 1,700 m.; 8 August 1935 (291). nov. var. **spinosa.** Folia fortiter, irregulariter dentata, fere laciniata. A form with the leaves much larger and more spreading, and the toothing much coarse than usual in this species, but I think must be considered a variety only. The calyptra agrees. Takuja, Naga Hills, 1,700 m.; November 1935 (346).

Bryaceæ.

Mielichhoferia assamica Dix. sp. nov.

E robustissimis generis. Caespitosa, viridis. Caulis 5 cm. altus, densifolius. Folia sicca madidaque patentia, sicca leniter contracta, parum mutata, 2-2.25 cm.

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longa, versus basin 4 mm. lata, fere e basi ad apicem sensim angustata, acuminata, peracuta; marginibus planis, ubique minutissime denticulatis. Costa tenuiuscula, cum apice evanida. Cellulae peliucidae, angustissimae, minutae, lineares, obtusae, parietibus tenuibus, strictis; basilares parum latiores.

Cetera ignota.

Hab. On sand, Bhorelli river bed, 300 m., Bhalukpung, Aka Hills; 2 November 1934 (211).

The largest species I know. An unpublished Himalayan species, now in the press, *M. Badhwarii* Dix., resembles it in size, but has much wider cells and sharper toothing.

Webera elongata Hedw.—In forest, 2,900-3,300 m.; Piri, Aka Hills, October 1933 (14, 41). Japwo, Naga Hills, 3,000 m.; October 1933 (300).

Webera cruda (Hedw.) Bruch—In forest, 2,900-3,300 m., Piri, Aka Hills; October 1933 (28).

Webera flexuosa (Hook.) Mitt.—In forest, 2,900-3,300 m., Piri, Aka Hills; October 1933 (17).

Webera humicola Dix. & Varde—Lozaphohemi, Naga Hills, 1,220 m.; November 1934 (304). Described in 1927 from the Palni Hills, South India, and not known elsewhere.

Brachymenium exile (Doz. & Molk.) Bry. jav.—Zehwera, Naga Hills, 1,800 m.; August 1935 (281b).

Brachymenium walkeri Broth.—Shillong, 2,000 m.; September 1934 (193). I cannot separate this from the Coorg plant.

Brachymenium nepalense Hook.—Zehwera, Naga Hills, 2,100 m., September 1935 (288).

Anomobryum cymbifolium (Lindb.) Broth.—Shillong, 1,500 m.; September 1934 (188). On rock, 1,700 m. Zehwera, Naga Hills; August 1935 (279 bis). Tree trunk, 1,700 m., Pedi, Naga Hills; September 1935 (285). All c. fr.

Bryum cellulare Hook.—Bhalukpung, Bhorelli river bed, 300 m.; November 1934 (214). Sterile.

Bryum argenteum Hedw.—Several gatherings.

Bryum porphyroneuron C.M.—Shillong, 1,400 m.; July 1934 (164). Fruit immature, but probably belongs here.

Bryum nitens Hook.—Shillong, 1,400 m.; September 1934 (182), c. fr.

Rhodobryum giganteum (Hook.) Par.—Piri, Aka Hills, 2,750 m.; November 1934 (245).

MNIACEÆ.

Mnium heterophyllum (Hook.) Schwaegr.—Pankim La, Abor Hills, 1934 (118).

Mnium lycopodioides (Hook.) Schwaegr.—In forest, 2,900-3,300 m., Piri, Aka Hills; October 1933 (16).

Mnium thomsoni Schimp.—Piri, Aka Hills, 3,000 m.; November 1934 (262, 267f). In fine fruiting condition. The capsule has a distinct collum, and is large; the lid is longly rostellate, almost rostrate.

Mnium lævinerve Card.—In forest, 2,700-3,300 m., Piri, Aka Hills; October 1933 (1, 35), c. fr. and ♂ plant.

Mnium rostratum Schrad. var. coriaceum (Griff.) Dix.—Pankim La, Abor Hills; 1934 (129, 136, 142). Shillong, 1,200 m.; September 1934 (201). And other gatherings. Mostly c. fr. This keeps its characters very constantly, and is, I am persuaded, deserving of varietal rank.

Mnium succulentum Mitt.—Piri, Aka Hills, 3,300 m.; November 1934 (267c).

Mnium punctatum Hedw. var. reflexifolium Kabiersch—In forest, 2,700-3,300 m., Piri, Aka Hills; October 1933 (27), c. fr. This seems a well marked variety.

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Orthomnion trichomitrium Wils.—Him Parbat, 2,000 m.; March 1934 (87). Tako Senyak, 1,200 m.; March 1934 (106). Both c. fr.

Orthomniopsis japonica Broth.—Pestiferous Camp, 1,375 m.; Piri, Aka Hills; November 1934 (229), c. fr.—An exceedingly interesting discovery. At the time of collecting it was known only from two localities in Japan. Since then, however, it has been found in New Guinea, and also in the Philippines.

Rhizogoniaceæ.

Rhizogonium spiniforme (Hedw.) Bruch—In several gatherings.

Bartramiaceæ.

Bartramia halleriana Hedw.—In several localities; Aka Hills, Abor Hills, and Naga Hills.

Bartramia leptodonta Mitt.—Piri, 3,000 m., Aka Hills; November 1934 (267g).

Philonotis gammieana Broth.—Tree trunk, 1,700 m., Piri, Naga Hills; September 1935 (286).

Philonotis angusta Mitt.—Charduar, 1934 (77). Aka Hills, 300 m.; November-December 1933 (44). Piri, Aka Hills; October 1933 (22). All c. fr.

Philonotis longicollis (Hampe) Mitt.—Naga Hills; 1935 (276) c. fr.

Erpodiaceæ.

Erpodium mangiferae C.M.—On mango tree, Charduar; July 1934 (163).

Hedwigiaceæ.

Cleistostoma ambiguum (Hook.) Brid.—Piri, Aka Hills; November 1934 (230).

Cryphaeaceæ.

Pilotrichopsis dentata (Mitt.) Besch.—In forest, 2,700-3,300 m. Piri, Aka Hills; October 1933 (23b). c. fr. A rather lax, slender form; but the species shows considerable variation, and I think it may be safely placed here. New to Assam. Distrib. China, Japan, Philippines.

Leucodontaceæ.

Leucodon secundus (Harv.) Mitt.—Pankim La, Abor Hills; 1934 (151).

Trachypodaceæ.

Diaphanodon blandus (Harv.) Ren. & Card.—Piri, Aka Hills, 3,000 m.; November 1934 (255, 261f). c. fr.

Diaphanodon thuidioides Ren. & Card.—Pankim La, Abor Hills; 1934 (138b). c. fr. Only known from the Central Himalayas and Yünnan, hitherto.

Trachypus bicolor Hornsch. & Reinw.—In several localities, mostly fruiting. One from Piri has the leaves strongly and prettily falcate.

Trachypus pendulus Dix. sp. nov.

Gracilis, atroviridis, habitu Diaphanodontis thuidioidis sed paullo robustior. Caulis pendulus, flexuosus, pinnatim ramosus, ramis circa 1 cm. longis, inaequalibus, caudiformibus. Folia patula, sicca, suberecta, plicata, e basi late fortiter auriculata oblongo-lanceolata, leniter asymmetrica, acumine torto, late loriformi, distanter denticulato. Costa tenuis, versus medium folium soluta. Cellulae lineares, pellucidae, tenerrime pluripapillosae, saepe fere laeves, basilares paullo latiores, pellucidiores.

Fructus ignotus.

Hab. Pankim La, Abor Hills, 300-2,745 m.; 1934 (138a).

Mixed with a rather robust form of *Diaphanodon thuidioides*, and not easy at once to separate, but the leaves with twisted apex, and long, pluripapillose cells clearly distinguish it under the microscope. The papillae are very slightly

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developed, however, for the genus. It also resembles to some extent *Duthiella Wallichii*, but the auriculate base, pellucid cells, and finely denticulate margins are very different.

Trachypodopsis auriculata (Mitt.) Fleisch.—Piri, Aka Hills, 2,700-3,300 m.; October 1933 (26), c. fr.

Trachypodopsis himantophylla (C.M.) Fleisch.—In several distinct localities, mostly at moderately high altitudes, sometimes fruiting. It is quite a marked plant, but I doubt whether it is more than a var. of *T. crispatula*.

PTEROBRYACEÆ.

Jægerinopsis integrifolia Dix. sp. nov. (Pl. I, fig. 6).

Pendula videtur. Caulis flexuosus, 10 cm. vel ultra longus, valde complanatus, parce, distanter ramosus, ramis divaricatis, inaequalibus (perbrevibus vel 1 cm. longis), complanatis, interrupte foliosis. Folia complanata, nunc laxa, nunc conferta, horride squarosa, usque ad 4 mm. longa vel paullo ultra, juniora viridia, seniora fusco-aurantiaca, e basi amplexicauli valde auriculata late ovata, subraptim in subulam strictam loriformem acutissimam integerrimam contracta. Costa brevis, debilis, nonnunquam bina, vel obsoleta. Cellulae angustissimae, lineares, incrassatae, basilares valde incrassatae, parietibus porosis, apud auriculas magnas pulchre aurantiacae.

Fructus unicus visus. Perichaetium longum, bracteis longe convolutis, superne subula abrupte reflexa, stricta, integra, robusta. Seta circa 4 mm., laevis, erecta. Calyptra, operculum, ignota. Peristomium flavidum, dentes lanceolati, hic illic conjuncti, laeves, saepe perforati, marginibus irregularibus; dorsaliter dissepimentis latis, intus sat alte, dense lamellati; fragmenta praeperistomii ad basin visa. Endostomium ut videtur rudimentarium.

Hab. Pankim La, Abor Hills, 300-2,750 m.; 1934 (138c).

The generic position of this plant is not quite certain. In the long, straggling, loosely branched stems, with complanate, very squarrose leaves, it is much like species of Jaegerinopsis, with which the leaf structure and general fruiting characters agree; the peristome is rather different from that characteristic of the genus, the teeth being longer and narrower, not short, broad and obtuse as is the case with the species where fruit is known. The presence of a praeperistome is in favour of Jaegerinopsis, but otherwise the teeth are more like those of Hildebrandtiella as figured by Brotherus.

A rather marked feature of the growth is the interrupted nature of the branches. The leaves may be normally large for some distance, then suddenly much smaller for a space; and sometimes a length of the stem or branch has only very minute, distant, spreading or squarrose leaves.

Endotrichella elegans (Doz. & Molk.) Fleisch. Dafla Hills, 1,375 m.; March 1934 (91), c. fr.

Symphysodontella subulata Broth.—Tako Senyak, 1,400 m.; March 1934 (93b), c. fr. I believe the fruit has not been seen before. Perichaetial bracts erect, convolute, few, acuminate; capsule exserted, seta 3-4 mm., roughish; capsule small, deoperculate scarcely more than 1 mm. long, erect, brown, turgidly elliptic; peristome almost lost, teeth pale, yellow, apparently like those of *S. cylindracea*. Only two old capsules seen. Only known from the Philippines.

Symphysodontella borii Dix. sp. nov. (Pl. I, fig. 7).

Sat robusta. Caulis secundarius indistincte dendroideus, vage pinnatim ramosus, ramis leniter curvatis, cuspidatis, nitidis, interdum subflagellaceis. Folia irregulariter disposita, nunc patentia, nunc erecta, sicca vix mutata, ecostata, 2-2.5 mm. longa e basi angustata ovato-lanceolata, concava, in acumen strictum, subulatum, cutissimum integerrimum angustata. Cellulae angustissimae, conflatae, parietibus tenuissimis, basilares vix mutatae, ad insertionem aurantiacae, alares magnae, numerosae, rotundatae, scalariformes, auriculas magnas, pulchre aurantiacas, decurrentes instruentes. Bracteae perichaetii lanceolato-subulatae, sat longae, erecto-patentes, robuste acuminatae, integrae. Seta 1-2 cm. vel paullo ultra, tenuis, stricta, laevis; theca parva, circa 2 mm. alta, ovalis, erecta, microstoma; exothecii cellulae laxae, hexagonae, parietibus tenuibus, firmis, versus orificium seriebus multis sensim minores. Calyptra cucullata, laevis. Operculum haud visum. Peristomium pallide aurantiacum;

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dentes anguste lanceolati, stricti, hic illic cohaerentes, interrupte tenerrime albide marginati, laeves, parum lamellati aut nodosi. Endostomium nullum.

Hab. Tako Senyak, Dafla Hills, 1,400 m.; 19 March 1934 (93), type. Dafla Hills, 1,200 m.; 20 March 1934 (90b).

The habit and the very strikingly auricled leaves are somewhat inconsistent with Symphysodontella, but the fruiting characters and general leaf structure agree well, and there is certainly no other genus in which it can be placed. The distinct alar cells of *S. tortifolia* described below confirm this.

Symphysodontella pilifolia Dix. sp. nov. (Pl. I, fig. 8).

Caulis secundarius subdendroideus, circa 6 cm. altus, supra irregulariter distanter pinnatim ramosus, ramis flexuosis, attenuatis, parce breviter ramulosis; sordide viridis, paullo nitida. Folia stipitis inferiora parva, squamiformia, superiora ut caulina 2-2.5 mm. longa, e basi auriculata late ovalia, cochleariformia, apice subito in pilum longum capillare flexuosum integrum contracta, integra seu ad basin pili minute denticulata; costa bina, irregularis. Cellulae angustissimae, inferne vix mutatae, ad insertionem seribus circa duabus latiores pulchre aurantiacae; alares nullae. Folia ramea similia sed angustiora, sensim piliformia.

Fructus ignotus.

Hab. Pankim La, Abor Hills; 1934 (116b).

Perhaps nearest to *S. involuta*, but quite distinct from all the species in the broad, cochleariform leaves abruptly piliferous. The nerve is sometimes single, with or without a short basal branch, sometimes with two subequal almost parallel branches, reaching to near mid-leaf.

Only a single stem was found.

Symphysodontella tortifolia Dix. sp. nov. (Pl. I, fig. 9).

Robusta. Olivaceo-viridis. Caules secundarii dendroidei, rigidi, circa 8 cm. alti, caule lignoso, infar nudo vel foliis squamiformibus adpressis memberanaceis obtecto; supra densissime (nonnunquam laxius) ramosi, ramis iterumque conferte ramulosis strictis, nitidiusculis, breviter cuspidatis, frondem subcomplanatam oblongam vel flabellaceam formantibus. Folia ramea patentia, stricta, e basi lata, cordata, auriculata, ovato-lanceolata, concava, raptim in subulam loriformem robustam valde tortam, fortiter argute distanter denticulatam angustata. Costa unica validiuscula, longe supra medium folium prolongata. Cellulae eis *S. pilifoliae* similes, sed alares numerosae, laxiusculae, aurantiacae, auriculas parvas sed notatas instruentes.

Fructus ignotus. Propagula viridia, articulata, brevia, fusiformia, inter folia (? axillaria) inveniuntur.

Hab. Japwo, Naga Hills, 2,900 m.; 7 December 1935 (339).

A remarkable species in the robust, regularly spirally twisted, sharply toothed acumen; the twisting may attain 1½ complete turns. The alar cells are conspicuous by their orange colour, but are much smaller and form smaller auricles than in *S. Borii*; they tend however to confirm the position of that species in the present genus.

It is remarkable that four species, three of them new, of this small genus of not more than fifteen or sixteen species, should occur in the limited area from which the present collections were made, and suggests that Assam must be considered the head-quarters of the genus. The Philippine Islands are the only region elsewhere known to contain as many as three species.

Pterobryopsis auriculata Dix. sp. nov. (Pl. I, fig. 10).

E robustioribus generis, *P. scabriusculae* (Mitt.) affinis et similis. Caulis secundarius 10-15 cm. longus, nunc sparse nunc conferte pinnatim ramosus, ramis parce brevissime ramulosis; omnes turgidi, densifolii, obtusi, vix nitidi. Folia patula, circa 2 mm. longa, latissime ovata, cochleariformia, supra cucullata, abrupte late breviter cuspidata, acuta, integra, ad basin auriculis pulchris haud magnis bene notatis praedita; costa unica tenuissima, circa dimidiam partem folii attingens. Cellulae lineari-rhomboideae, tenerrimae, laeves, basilares minime latiores, intra auriculas paucae lavae, hyalinae.

Fructus ignotus.

Hab. Bark of tree, 100 m., Charduar; 16 October 1934 (205), type. Manalur, Lower Palnis, Madura, 18 June 1926, coll. G. Foreau (370).

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Nearest perhaps to *P. scabriuscula* (Mitt.), but quite distinct in the auriculate base. *P. conchophylla* (Ren. & Card.) is a much smaller plant with numerous alar cells. *P. madurensis* (Card. & Varde) with a considerable resemblance in habit has much less developed auricles and very numerous alar cells.

METEORIACEÆ.

Papillaria fuscescens (Hook.) Jaeg.—Several gatherings.

Meteorium Buchanani (Brid.) Fleisch.—Chingku, Naga Hills, 2,500 m.; November 1935 (355). A form with the long hair points of *M. Miquelianum*, but with non-plicate leaves.

Aerobryopsis denticulata Dix. sp. nov.

Pendula, extensa, mollis, viridis, habitu specierum Barbellae, e.g. *B. spiculata* (Mitt.); ramis percomplanatis, nunc sparsim, nunc confertius, aequaliter pinnatis. Folia caulina et ramealia subsimilia, late divaricata, e basi contracta cordata, breviter decurrente, amplexicauli, cordato-ovata, acuminata, acumine longo, tenui, saepe torto, argute denticulato. Margines plani, nullo modo undulati, ubique argute, fortiter denticulati. Costa tenuissima, circa medium folium attingens, interdum obsoleta. Cellulae praelongae, angustae, saepius uni—, interdum pluri-papillosae, papillis parvis; basilares subsimiles, alares perpaucae laxiores.

Fructus ignotus.

Hab. Satoi, Naga Hills, 2,150 m.; 4 December 1935 (367).

Distinct in its slender, complanate, Barbelloid habit, the nonundulate, sharply toothed margins, and long, narrow cells. In foliation it is perhaps nearest to *A. striatula*, but the marginal toothing and areolation are quite distinct.

Floribundaria floribunda (Doz. & Molk.) Fleisch.—Piri, Aka Hills; November 1934 (241), c. fr. Pestiferous Camp, 1,200 m., Piri, Aka Hills; November 1934 (221). This last is a peculiar form, very slender and delicate in habit, with irregular, not regularly seriate papillae, but with obscure cells, and very weak nerve. It may be *F. pseudo-floribunda* Fleisch, which however seems to me a poorly marked species.

Chrysocladium horridum Dix. sp. nov.

Habitus, color et magnitudo *C. phaei* (Mitt.); ab illa et affinibus differt toto coelo foliorum structura, cellulis nullo modo obscuris, nec opacis, sublaevibus vel 3-4-papillosis, papillis nunc altis, spiculosis, nunc minutissimis vel nullis. Folia superne marginibus undulatis, densissime acutissime denticulatis; cellulae alares distinctae, laxae, aurantiacae, alas parvas sed bene notatas instruentes.

Sterilis tantum nota.

Hab. Naga Hills, 1935 (272), type. Japwo, Naga Hills; 7 December 1935 (332).

Quite distinct from *C. phaeum* and the allied species in the pellucid, neither obscure nor opaque cells, sometimes highly 3-4-papillose, sometimes quite smooth. An unpublished species from Yunnan is in some respects very like it, but has different foliation, and the cells, though sparsely papillose as here are very opaque and obscure with the primordial utricle, which is not at all the case in the present plant.

Barbella enervis (Thw. & Mitt.) Fleisch.—Pestiferous Camp, 1,500 m., Piri, Aka Hills; November 1934 (226).

Lindigia asiatica Dix. sp. nov. (Pl. I, fig. 11).

E robustioribus generis. Sordide viridis. Caulis circa 8 cm. longus, flexuosus, compalanate pinnatim irregulariter ramosus, ramis usque ad 2 cm. longis, complanatis, 4-5 mm. latis. Folia divaricata, subsquarrosa, complanata, 3 mm. longa, e basi subcordata sensim attenuata, acumine stricto, tenui-acuminato, aciculari; margines plani, ubique argute denticulati. Costa ad basin sat valida, supra tenuis, circa 2/3 folii attingens. Cellulae latiuscule lineari-rhomboideae, laeves, parietibus tenuibus; ubique subsimiles, ad insertionem tantum laxiores.

Ditissime fructificans. Fructus ad ramos situs, perichaetia parva, bracteis breviter acuminatis; seta vix ultra 1 mm. longa, crassiuscula, laevis. Theca

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erecta, fusca, ovalis, 1 mm. longa, sicca macrostoma; operculum acute conico-curvirostellatum. Exothecii cellulae seriebus verticalibus, rectangulares, parietibus rectis, sat crassis. Peristomium pro thecae magnitudinem magnum; dentes usque ad .5 mm. longi, pallidi, madidi pulchre leniter recurvati, lanceolati, e basi angustati, angustissime acuminati, tenues, vix lamellati, ubique tenere regulariter papillosi, linea media leniter angulata, scutulis irregularibus, saepe subquadratis. Processus e membrana brevissima vel nulla filiformes, tenerrimi, breviores, sublaeves, hic illic rimosi. Spori 26-20μ laeves.

Hab. Him Parbat, 2,000 m.; 21 March 1934 (81). No doubt corticolous.

A prettily fruiting, graceful plant. In habit not unlike the above described *Jaegermopsis integrifolia* (see Plate), though with less rigidly divaricate leaves; but the resemblance ends there. It is the first species of the genus to be found in Asia, and a very distinct one. Of the other nine species one is from Tropical Africa, one from Madagascar, the remainder from tropical or sub-tropical America.

C. Müller has divided the genus into two sections; Eulindigia with comparatively short stems and short, simple branches, linear-rhomboid cells, a very short seta, striolate peristome teeth and long-beaked lid, while Genucaulis has a very long stem, with long ramulose branches, elliptico-rhomboid cells, seta 4-7 mm., papillose teeth, and a short-beaked lid. The present plant has the vegetative characters and short seta of Eulindigia, the lid and papillose teeth of Genucaulis. It seems impossible, therefore to maintain this arrangement, and it would be better to drop it, or to make the division depend on the character of the peristome teeth alone.

Meteoriopsis squarrosa (Hook.) Fleisch.—Shillong, 1,800 m.; September 1934 (202). With very young fruit.

Meteoriopsis reclinata (C.M.) Fleisch.—In several gatherings.

Aerobryum speciosum Doz. & Molk.—Pestiferous Camp, 1,200 m., Piri, Aka Hills; November 1934 (219). Hanging from branches, Bompur La, Aka Hills, 1,800 m.; November 1934 (234). The latter a fine plant, with stems a foot long. and nicely in fruit.

NECKERACEÆ.

Calyptothecium urvilleanum (C.M.) Broth.—Him Parbat, 2,000 m.; March 1934 (107). Hanging from branches, Bompur La, Aka Hills, 1,800 m.; November 1934 (238). Both represent a rather slender form. I have elsewhere (*Journ. of Bot.*, 1937, p. 121) given reasons for considering the Indo-Malayan *C. philippinense* Broth. to be identical with the Pacific species.

Calyptothecium sp.— Rubber tree, Charduar; November 1934 (207). A distinct species which is very near to *C. mysorense* Broth. ined. (Bryoth. E. Levier, 5,905), but differs in some slight respects, and I hesitate therefore to record it with certainty as that species.

Neckera himalayana Mitt.—(Syn. *N. longe-exserta* Hampe). Japwo, Naga Hills, 2,900 m.; October 1935 (320), c. fr. I have compared Hampe's type with Mitten's, they are exactly the same thing. The seta is remarkably long for the genus.

Neckeropsis gracilenta (Bry. jav.) Fleisch.—Gomarai, near Shillong, on bark of tree; August 1934 (174). New to Assam.

Himantocladium plumula (Nees) Fleisch.—Him Parbat, 1,800 m.; March 1934 (101).

Himantocladium scabrisetum Dix. sp. nov.

Strips rigida, habitu *H. flaccidi* aut *H. cyclophylli*. Saturate viridis. Rami haud flagellacei. Folia stricta, sicca vix mutata, rigide divaricata, caulina (nec ramea) transverse undulata, e basi latiore concava, breviter late oblonga, apice triangulari-rotundato, parce argute denticulato. Costa tenuissima, circa dimidiam folii partem attingens, saepe brevior, nonnunquam obsoleta. Cellulae medianae lineari-rhomboideae, superiores rhomboideae. Folia ramea angustiora, minora. Dioicum videtur. Perichaetium longum, bracteis strictis, erectis, superne longe ligulatis, subacutis, integris. Seta circa 1 cm., scabra, ad basin laevis; crassiuscula. Theca e collo brevi turgide elliptica, deoperculata 2.5 mm. longa.

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Peristomium pallidum, dentes teneri, vix lamellati, grossiuscule aequaliter papillosi; processus e membrana basilari perbrevi subaequilongi, perangusti, aciculares, dense alte papillosi. Operculum haud visum.

Hab. Naga Hills; 1935 (278).

So far as is known, this is the only species of the genus with scabrous seta. It also differs from its allies in the very thin, faint short nerve; the upper cells also are more elongate than in most species. *H. strictum* Dix. from Siam is the most closely allied, and may indeed be conspecific, but the fruit has not been found. It is still more rigid than the present plant, with the leaves rarely transversely undulate, sometimes longitudinally plicate, and with a rather longer and stronger nerve; but the differences are not very great.

Homaliodendron montagueanum (C.M.) Fleisch.—Him Parbat, 1,800 m.; March 1934 (107), c. fr. I name this on account of the almost simple or very slightly branched stems; but it scarcely differs from *H. javanicum* or *H. flabellatum* (with which it was growing) in any other respects.

Homaliodendron flabellatum (Dicks.) Fleisch.—Tako Senyak, Dafla Hills, 1,200 m.; March 1934 (105b), c. fr.

Homaliodendron scalpellifolium (Mitt.) Fleisch.—Pankim La, Abor Hills, 1934 (127), c. fr. Shillong, 1,200 m.; September 1934 (187), ♂ plant. Piri, Aka Hills, 2,750 m.; November 1934 (249, 251), c.fr. Japwo, Naga Hills, 2,500 m.; October 1935 (315), c. fr.

Homaliodendron longisetum Dix. sp. nov.

Robustum. Caulis primarius repens, dense tomentosus. Caulis secundarius inferne simplex, elongatus, foliis stipitis infernis squamiformibus, parvis, recurvis, acuminatis, supernis foliaceis, membranaceis, laxis, patentibus, acutis, integris. Caulis superne complanate dendroideus, flabellatus, ramis ad 2 cm. altis, nunc parce distanter pinnatis, nunc plus minusve dense bipinnatis. Folia percomplanata, eis *H. javanici similia,* sed costa multo validiore, longiore, saepe paullo infra apicem soluta. Cellulae rhomboideo-ellipticae, parietibus tenuibus.

Perichaetii bracteae breves, breviter late acuminatae, denticulatae. Fructus saepe numerosi. Seta 1.25-1.5 cm. longa, tenuis, inferne laevis, parte superiore sat alte papillosa. Theca pallide fusca, elliptica, leniter gibbosa, deoperculata circa 3 mm. longa; operculum longe curvirostre. Peristomium generis, albida. Calyptra nuda.

Hab. In forest, 2,900-3,200 m., Piri, Aka Hills; October 1933 (7, 29), type. Ibidem, 2,300 m., 17 November (246).

One of the most distinct species in the long, rather stout nerve, the seta elongate as in no other species, and papillose in the upper part. The fronds are sometimes laxly and slightly branched, as in *H. Montagueanum,* sometimes (in the same gathering and even on the same stem) densely bipinnate, as in *H. flabellatum,* showing the slight value that can be attributed to this as a character.

Handeliobryum assamicum Dix. sp. nov. (Pl. I, fig. 12).

Ab *H. setschwanico* et *H. himalayano* Broth. differt foliis versus apicem grosse et inaequaliter obtuse sinuato-denticulatis.

Hab. Rocks in stream, Piri, Aka Hills, 2,700 m.; 17 November 1934 (247).

An interesting link in the distribution of this recently known, striking and peculiar genus, between the Himalayan and Chinese localities. The two described species only differ from one another in habit; they are described as having the leaf apex entire or with a few minute denticulations; here they are constantly obtusely, rather coarsely, though not strongly sinuate-denticulate. It is obviously a more or less aquatic plant.

HOOKERIACEÆ.

Daltonia marginata Griff.—Piri, Aka Hills, 2,600 m.; November 1934 (243a). Mitten describes the calyptra as reaching to the middle of the capsule, but I find it, in Griffith's plant, as here, scarcely reaching below the lid. Griffith is the author of the specific name, not Mitten as Brotherus has it.

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Daltonia perlaxiretis Dix. sp. nov. (Pl. I, fig. 13).

Robusta, elata, usque ad 2 cm. alta, caespitosa. *D. reticulatae* C.M. ceylonensi affinis, differt limbo folii angustiore, cellulis multo laxioribus, valde pellucidis, seta longiore, theca angustiore. Folia 3 mm. longa et paullo ultra, fusiformia, leniter (infra fortiter) carinata, longe, tenuissime cuspidata, limbus superne 2-3-seriatus; cellulae superiores hexagonae, 14-20 μ latae, inferne multo laxiores, omnes perpellucidae, parietibus tenuissimis. Costa sat longe sub apice desinens. Seta laevis, circa 8 mm. sub collo leniter geniculata, unde theca inclinata. Theca e collo distincto breviter cylindrica, atro-viridis. Operculum longiuscule acuate rostratum. Peristomium pulchre albidum; dentes densissime, altissime tenuissime papillosi, imperforati; processus simillimi sed angustiores.

Hab. Piri, Aka Hills, 2,500 m.; 17 November 1934 (264).

A very pretty little plant, in neat tufts, richly fruiting, with bluish green capsules in strong contrast to the large, white, persistent calyptra. The capsules are unusually narrow, and are inclined or even horizontal owing to the geniculation of the seta below the distinct collum. In *D. reticulata* the cells are about 8-14 μ wide, the capsule wider, the seta shorter.

Daltonia gemmipara Dix. sp. nov. (Pl. I, fig. 14).

Species valde abnormalis, corticola vel in aliis muscis epiphtytica, saturate viridis, caespitosa, gracilis, mollis, siccis foliis valde crispatis. Caules dense intricati, circa 1 cm. alti, crassi, rufi; folia conferta, flexuosa, saepe subfalcata, circa 2 mm. longa, flexuosa vel subsigmoidea, e basi latiore ligulata, obtusa, profunde sed late carinato-canaliculata; costa lata, carinam implens, superne parum angustata, sub summo apice soluta. Margines folii superne late fortiter revoluti, unde folium revolute subtubulosum fit. Limbus superne sat angustus. Cellulae superiores hexagono-rectangulares, irregulares, perchlorosae, parietibus tenuibus; inferne sensim laxiores. Folia suprema falcata, saepe apice in penicillium chlorophyllosum vel hyalinum expanso, e filis articulatis tenerrimis densissime confertis instructum.

Fructus ignotus.

Hab. Pulebudze, Naga Hills, 1,850 m.; on rotten wood mixed with other mosses and often growing on them; August 1935 (293c).

A very remarkable plant. The highly chlorophyllose, more or less rectangular cells are unusual, but not unknown in the genus. The leaves are ligulate from a slightly wider base, and in the upper part more or less tubular, but from the widely *revolute*, not involute margins; the nerve is rather wide throughout, occupying a deep channel in mid-leaf. The upper leaves are often gemmiparous, in this case being falcate at the tip, and the rather obtuse apex emits a small, dense felt of extremely delicate, but wide, articulate threads, forming a penicillate or flabellate head, between .25 and .5 mm. in length. I have found very small, fusiform, articulate gemmae on these, but am doubtful if these were in situ; it is more probable that the threads themselves are immature, and would later develope into articulate, detachable gemmae.

Hookeria acutifolia Hook.—In forest, Piri, Aka Hills, 2,700-3,300 m.; 1934 (39), c. fr.

Chaetomitriopsis glaucocarpa (Reinw.) Fleisch.—Pankim La, Abor Hills, 1934 (121, 131, 146), c. fr.

Hypopterygiaceæ.

Cyathophorum intermedium Mitt.—Balipara Frontier Tract, foot of Aka Hills, under 300 m.; November-December 1933 (50b). Only a scrap.

Dendrocyathophorum paradoxum (Broth.) Dix.—Him Parbat, 2,000 m.; March 1934 (95). I have already pointed out in some Notes in *Journ. of Bot.*, 1937, p. 125, that this plant, described as a new genus and species by me in *Journ. of Bot.*, 1936, p. 7, was found to be identical with the Japanese moss, *Hypopterygium paradoxum* Broth. Its generic distinction, between Hypopterygium and Cyathophorum, is unquestioned, and its name must be as above. It is a similar instance of geographical distribution to that of *Orthomniopsis japonica*, given above.

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FABRONIACEÆ.

Fabronia assamica Dix. sp. nov.

E minutissimis generis. Folia paullo latiora quam in *F. secunda*, brevius pilifera, minute denticulata, cellulis multo brevioribus, plerumque 3-4 × 1. Costa pertenuis, saepe obsoleta. Theca perminuta, operculata vix .75 mm. longa. Operculum conicum.

Hab. Shillong, 1,700 m.; 1 September 1934 (186).

Nearest to *F. secunda* in the narrow leaves, but more delicate, with laxer, smaller leaves, much shorter cells, and very minute capsule. The lid is bluntly conical when moist, but becomes apiculate when dry. *F. minuta* Mitt. has much denser foliation and much wider leaves.

LESKEACEÆ.

Pseudoleskeopsis decurvata (Mitt.) Broth.—Somma, 100 m.; March 1934 (79).—This has the basal sinus of the leaf nearer to that of *P. decurvata* than *P. orbiculata*, as figured by Thériot, but I must confess I find this character rather ill defined and elusive; and I am inclined to doubt the value of several of the species described in this genus. The nerve of the perichaetial leaf here is long, but not nearly percurrent. The margin is mostly plane, but sometimes recurved on one side.

THUIDIACEÆ.

Haplocladium subulaceum (Mitt.) Broth.—Naga Hills; 1935 (280).

Claopodium nervosum (Havr.) Fleisch.—Balipara Frontier Tract, foot of Aka Hills, below 300 m.; November-December 1933 (50, 61).

Claopodium assurgens (Sull. & Lesq.) Card.—Tree trunk, Dulungmukh, 200 m.; February 1934 (71).

Thuidium bifarium Bry. jav. var. pertenue Lac.—Bark of tree, Aka Hills, 300 m.; November 1934 (216). A well marked variety, which may be, as Fleischer describes it, a distinct species. It is characterized, for one thing, by a roughish seta. It has only been recorded from Celebes.

Thuidium Brotheri Salm.—Pankim La, Abor Hills; 1934 (120, 130, 134). I am very doubtful whether this be distinct from *T. asperulisetum*.

Thuidium asperulisetum Ren. & Card.—Balipara Frontier Tract, foot of Aka Hills, under 300 m.; November-December 1933 (43 p.p.). Pulebudze, Naga Hills, 600 m.; Aug. 1935 (293).

Thuidium Meyenianum (Hampe) Jaeg.—Charduar, 1934 (75).

Thuidium subpellucens Dix. sp. nov.

Thuidiella *T. squarrosulo* Ren. & Card. affine; differt praecipue cellulis haud opacis, valde pellucidis, et costa dorso laevi. Bipinnatum. Saturate viride. Seta laevis, theca inclinata, curvata.

Hab. Piri, Aka Hills, 2,750 m.; 17 November 1934 (244).

Very similar to *T. squarrosulum* in the habit, squarrose stem leaves, foliation and fruit, but differing entirely in the cells, which though bearing the same high central papilla are very pellucid, instead of being opaque and obscure; the nerve also, while prominent at the back, is less so, and smooth, while there it is markedly roughened or denticulate.

Thuidium orientale Mitt.—Bhalukpung, 300 m., Aka Hills; November 1934 (213).

Thuidium cymbifolium (Doz. & Molk.) Bry. jav.—Several gatherings.

Actinothuidium Hookeri (Mitt.) Broth.—Japwo, Naga Hills, 2,750-3,000 m.; December 1935 (335).

AMBLYSTEGIACEÆ.

Ortholimnobium Dix. gen. nov. Amblystegiarum.

Humilis. Caulis vage ramosus. Folia subcomplanata, latissime cordata, ecostata, alis decurrentibus parvis, laxis, pellucidis. Seta breviuscula. Theca

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erecta, symmetrica, elliptica, leptodermica; exothecii cellulae laxae, hexagonae. Peristomium albidum, dentes pellucidi, inferne transverse, medio oblique vel verticaliter striolati, superne leniter papillosi; intus sat alte lamellati. Processus subaequilongi, perpellucidi, laeves vel sublaeves, rimosi, ad dentes plus minusve adhaerentes; membrana basilaris humillima. Cilia O. Spori parvi. Operculum acute conicum.

Ortholimnobium Borii Dix. sp. unicum. (Pl. I, fig. 15).

Laxe caespitosum, gracilescens pallide viride, subnitidum. Caulis vage ramosus, vix radiculosus; rami valde irregulares, teneri, molles, usque ad 2 cm. longi, complanati, saepe attenuati. Folia laxiuscula, 1 mm. longa, 1 mm. lata, latissime cordata, breviter acute cuspidata, integerrima; costa nulla vel raro brevissima, bina; cellulae perangustae, lineares, pellucidae, parietibus tenuibus, subconflatis; basilares medianae paullo laxiores, ad angulos decurrentes abrupte dilatatae, hyalinae, tenerae, late rectangulares, auriculas decurrentes optime notatas instruentes.

Dioicum videtur. Flores cauligeni, interdum ramigeni. Perichaetia minuscula, bracteae erectae, appressae, brevissime late cuspidatae. Seta circa 1.25 cm. longa, laevis, rubra; theca circa 2 mm. longa, erecta, raro indistincte inaequalis. Spori circa 15 μ.

Hab. Piri, Aka Hills, 2,300 m.; 17 November 1934 (252).

The affinities of this plant are not quite certain, but vegetatively it appears not unlike some Hygrohypna, and I think should be placed near that genus. The structure of the teeth is rather peculiar. The dorsal plates are very finely but distinctly transversely striolate, to about the middle of the teeth; a few plates then are irregularly striolate, obliquely or vertically; and the upper part of the teeth is faintly papillose or almost smooth. The widely cordate leaves, almost or quite as broad as long, will enable the plant to be recognized at once from anything likely to be confused with it.

Brachytheciaceæ.

Brachythecium Buchanani (Hook.) Jaeg.—Kanyang, 1,700 m.; Naga Hills; November 1935 (365).

Oxyrrhynchium riparioides (Hedw.) Jenn.—Shillong, 1,800 m.; September 1934 (202 p.p.).

Oxyrrhynchium Mulleri (Lac.) Broto.—In forest, 3,000-3,300 m., Piri, Aka Hills; October 1933 (6).

Nov. var. **minus** Dix. Omnibus partibus, praecipue foliis, minus. Folia vix 1.25 mm. longa.

Piri, Aka Hills, 2,900 m.; November 1934 (250), type of var. Rocks in stream, 2.750 m., Piri; November 1934 (259).

So slender and different from the ordinary plant that I had at one time decided to describe it as a new species; there is really, however, so far as I have been able to ascertain, nothing but the size to distinguish it from *O. Mülleri*, and the presence of that species in the near vicinity tends to confirm this. Both plants were in fruit, which seems to show no difference from the type, except that the seta is a little shorter.

Eurhynchium dumosum (Mitt.) Jaeg.—In forest, 2,900-3,300 m., Piri, Aka Hills; October 1933 (1). Shillong, 1,800 m.; September 1934 (20 p.p.).

Rhynchostegiella scabriseta (Schwaegr.) Broth.—Pankim La, Abor Hills; 1934 (141).

Rhynchostegiella assamica Card. & Dix.—Charduar, 200 m.; February 1934 (67).

Rhynchostegiella percomplanata Dix. sp. nov.

R. aciculae Broth. & Par. affinis, sed multo major, valde complanata, ramis ad 1 cm. longis, pulchre plumosis. Folia 2.5 mm. longa, lanceolata, acuminata, vel integra, vel plus minusve distincte denticulata. Cellulae lineari-rhodmboideae, elongatae, perangustae, basilares 2-3-seriatim multo laxiores, hyalinae.

Perichaetium parvum, bracteis brevibus, patulis, stricte acuminatis, denticulatis. Seta circa 1.25 cm. alta, laevis.

Hab. Bark of tree, 200 m., Piri, Aka Hills; 13 November 1934 (210).

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Very near to *R. acicula*, but much more robust, and with leaves nearly always—and often sharply—denticulate. It belongs to the group of which *Hypnum menadense* Bry. jav. may be considered the type, which seem equally at home in this genus or in Rhynchostegium.

Rhynchostegium herbaceum (Mitt.) Jaeg.—Balipara Frontier Tract, foot of Aka Hills; November-December 1933 (53). Pestiferous Camp, Piri, Aka Hills, 1,200 m.; (228, 222). Wokka Hill, Naga Hills, 1,850 m.; October 1935 (289). Khüvubhu, Naga Hills, 1,500 m.; November 1935 (344). All in fruit.

Rhynchostegium Hookeri Jaeg.—Pestiferous Camp, Piri, Aka Hills, 1,200 m.; November 1934 (220).

Rhynchostegium Duthiei C.M. MS. sp. nov.

Sat robustum, haud nitidum. Rami densi, suberecti, haud complanati, sicci curvati, subobtusi, Folia imbricata, saepe leniter secunda, 2 mm. longa, cordato-ovata, breviter acute acuminata, apice semitorto, denticulato. Costa sat angusta, sub acumine soluta. Cellulae angustissimae, basilares omnes laxiores.

Autoicum. Perichaetia majuscula, bracteis superne stricte late acuminatis, denticulatis, patulis. Seta circa 1.5 cm. alta, laevis, rubra; theca turgidiuscule elliptica, curvata, gibbosa, fusco-aurantiaca. Operculum longirostre.

Hab. Arnigadh, 1,675 m., Mussoorie, N.W. Himalaya, leg. W. Gollan, 13 December 1895; det. Brotherus (E. Levier-Bryoth. exot., No. 72), type. Simla, March 1902, leg. Mrs. Roper, Herb. H. N. Dixon (66, 76). Ibidem, 1924, leg. Dr. Ghose, 1924, Herb. H. N. Dixon (99). Moist places, 3,350 m., Bias Valley, Kulu, N.W. Himalaya, 9 September 1928; leg. Badhwar (1091). Piri, 2,900-3,300 m., Aka Hills, Assam, October 1933, leg. N. L. Bor (31).

This species, distributed by Levier in the Bryotheca Exotica, has not been published. It is distinguished by its non-complanate, often secund leaves, rather wide and short, and half-twisted at apex, by the branches curved when dry, and the very narrow upper cells; it is in fact of more Eurhynchioid habit than most species. The Assam plant is more robust, with larger leaves, longer seta, and shorter lid, but I think belongs here.

Rhynchostegium pellucidum Dix. sp. nov.

Gracile; saturate viride; inter alios muscos repens. Caulis prostratus, ad 6 cm. longus, pinnatus, ramis brevibus. Folia laxiuscula, vix complanata, sicca parum contracta, flexuosa, vix nitida, parva, circa 1.5 mm. longa, lanceolata, tenui-acuminata, minute denticulata, costa tenuissima, brevis, vix medium folium attingens. Cellulae lineari-rhomboideae, pellucidae, infra sensim laxiores, basilares laxae, alares majusculae, rectangulares, hyalinae.

Fructus ignotus.

Hab. On dead branch, 1,850 m., Pulebudze, Naga Hills, 8 August 1935 (293f).

A delicate plant with narrow leaves, and of a distinct habit; its position is a little doubtful. In leaf form it is not unlike *Rhynchostegiella percomplanata* described above, but the habit, and the position of the leaves when dry, are quite different, and it has not the characters of a Rhynchostegiella.

SYMPHYODONTACEÆ.

Symphyodon scabrisetus Dix.—In forest, 2,700-3,300 m., Piri Aka Hills; October 1933 (13). Tako Senyak, Dafla Hills, 1,400 m.; March 1934 (102).

ENTODONTACEÆ.

Entodon flavescens (Schwaegr.) Jaeg.—Chingku, Naga Hills, 2,600 m. November 1935 (352).

Entodon luridus Griff.—Pankim La, Abor Hills; 1934 (126). This is *E. luridus* according to Brotherus' arrangements; I have not seen Griffith's plant, which, indeed, appears not to exist.

Entodon ovicarpus Dix. sp. nov.

? Erythropus. Late expansus, sordide viridis, vix nitidus. Rami haud complanati, turgidi, subjulacei, obtusi. Folia conferta, e basi paullo contracta ovata, breviter, raptim, acute vel subobtuse cuspidata, perconcava, fere cochle-

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ariformia, subintegra; cellulae angustiusculae, alares magnae, subhyalinae, haud partem majorem latitudinis folii occupantes.

Bracteae perichaetii longe, flexuose acuminati. Seta vix 1 cm. longa, (matura) pallide rubra, crassiuscula. Theca turgide ovata, deoperculata 2.5 mm. longa; exothecii cellulae laxae, hexagonae, fere isodiametricae, parietibus tenuibus. Peristomium fusco-rubrum, dentes breves, marginati, infra horizontaliter, supra verticaliter striolati. Processus rudimentarii. Operculum haud visum.

Hab. Pankim La, Abor Hills, inter 300 et 2,900 m.; 1934 (132).

Quite distinct in the subjulaceous, obtuse branches, short seta, ovoid capsule, lax exothecium cells, and rudimentary processes. It is not certain to which of the two divisions of the genus it belongs as the fruit is in all cases overripe, and the seta when younger may have been either yellow or red.

Entodon plicatus C.M.—Newly, 300 m., January 1934 (72). Dafla Hills, March 1934 (108).

Erythrodontium julaceum (Hook.) Par.—Several gatherings.

Pylaisia aurea (Hook.) Broth.—Shillong, 1,800 m.; September 1934 (184).

Pylaisiopsis speciosa (Wils.) Broth.—Naga Hills: 1935 (283). I believe this has not been collected since its first discovery by Hooker. It quite sustains the peculiar characters as given by Brotherus. The outer teeth of the peristome are as shown by him in his figure, but the abrupt transition from the lower half to the subula is even more strongly marked, forming indeed a distinct square shoulder. The processes when mature are split from top to bottom, and each half curves away from the other and outwards in a graceful and striking manner. The spores are very large, but I have not found them nearly equalling the measurements given by Brotherus. It is a remarkable plant.

Campylodontium flavescens (Hook.) Bry. jav.—Him Parbat, 2,000; March 1934 (92).

Stereophyllum anceps (Bry. jav.) Broth.—On *Ficus elastica*, Charduar; June 1934 (161).

Sematophyllaceæ.

Clastobryum subplanulum Broth.—Piri, Aka Hills, 2,500-3,300 m.; November 1934 (243b, 254, 261), c. fr. These specimens differ somewhat from one another and from the type, but they must clearly all be referred to the same species. The propagula when present are very densely crowded, and may be very finely papillose. The plant is bi-tripinnate in its branching.

Aptychella Borii Dix. sp. nov. (Pl. I, fig. 17).

Pro genere sat robusta, viridis. Caulis prostratus, radiculosus, laxe ramosus; rami prope apicem saepe fila articulata axillaria hyalina densissime fasciculata laevia emittentes. Folia complanatula, 2-2.5 mm. longa, concava, ovata, breviter acute cuspidata, plerumque integra, subecostata. Cellulate laeves, angustissimae, basilares saepe aurantiacae, ad angulos numerosae, laxae, hyalinae, alas bene notatas, teneras, decurrentes formantes.

Fructus ignotus.

Hab. Pulebudze, Naga Hills, 1,850 m.; 8 August 1935 (293d). Nearest to *A. heteroclada* Fleisch., but deep green, more rigid, the leaves with shorter points, and the brood-filaments colourless.

Aptychella planula (Mitt.) Fleisch.—Chingku, Naga Hills, 2,500 m.; November 1935 (358), c. fr.

Hageniella assamica Dix. sp. nov. (Pl. I, fig. 19).

Densissime caespitosa viridis, vix nitida, ramis brevibus, leniter curvatis, densifoliis, brevissime cuspidatis. Folia conferta, saepe secunda, subfalcata, minuta, caulina circa 1 mm. longa, e basi contracta late ovata cochleariformia, raptim tenuissime acuminata, subpilifera, enervia; ramea minora, magis sensim brevius acuminata. Cellulae parvae, perangustae, subrhomboideae, pellucidae, dorso nunc laeves, nunc sat fortiter sed tenere papillosae; alares sat numerosae,

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perdistinctae, hyalinae, majusculae, vix vesiculosae, alte ad margines adscendentes; basilares flavidae.

Dioicum videtur. Perichaetii bracteae erecto-patentes; e basi lata, convoluta, raptim in acumen longum, acutissimum, arcte, fortiter denticulatum contractae. Seta 1-1.25 cm. longa, tenuis, laevis. Theca horizontalis, elliptica, parva, deoperculata 2 mm. longa, fusco-purpurea, sicca sub ore constricta; exothecii cellulae laxae, subisodiametricae, parietibus valde flexuosis. Operculum rostellatum. Peristomium flavidum, dentes ad basin conjuncti, inferne dense striolati, superne sublaeves; intus fortiter lamellati; endostomium plus minusve papillosum, processus latiusculi, rimosi, variabiles. Cilia ? Spori circa 22 μ, laete virides.

Hab. Japwo, Naga Hills, 2,750 m.; October 1935 (305).

A rather larger plant than *H. sikkimensis,* of quite different colour, with longer, subpiliferous points to the stem leaves, longer capsule, very different perichaetium, and more regularly developed peristome.

Hageniella isopterygioides Dxi. sp. nov. (Pl. I, fig. 18).

Dense caespitosa, humilis, nitida. Caulis ramosus et ramulosus, rami percomplanati, haud curvati. Folia parva, complanata, divaricata, eis *H. sikkimensis* forma subsimilia, sed longius acuminata; cellulae omnino laeves, alares utrinque 3-4, magnae, subvesiculosae, hyalinae vel flavae, supra-alares paucae, hyalinae, majusculae. Perichaetii bracteae eis *H. assamicae* similes sed breviores, argute, distanter denticulatae. Seta circa 1 cm. longa, inferne intense rubra, theca erecta, plerumque omnino symmetrica, structura ei *H. assamicae* similis. Peristomium simile, sed processus magis regulares, angustiores, dentibus aequilongi, rimosi. Cilia O.

Hab. Chingku, Naga Hills, 2,650 m.; 5 November 1935 (356).

That this is a Hageniella is not quite certain, the capsule being erect and symmetrical, the leaves complanate, glossy, and quite smooth. On the other hand the structure of the capsule and the peristome are exactly the same as in the last species, which is certainly a Hageniella, and the cell structure, apart from the papillae, quite similar. It seems hardly desirable to create a new genus for it, on account of the above differences, while in other respects so closely allied.

There is a curious resemblance between this plant and *Leiodontium complanatum* described below, in habit, leaf form, size, and capsule; so much so that they might easily be confused. The principal difference, and of course an important one, in the leaf, is the Sematophylloid alar cells in the present plant; but the Leiodontium also has differentiated alar cells of something the same form, though on a much smaller scale, and less vesiculose. The peristome is remarkably similar in both, until examined with a high power, when the teeth of the Leiodontium (which moreover are rather irregular) are seen to be smooth, not striolate. The capsule there also is wider and more ovoid, with rather smaller exothecium cells.

Hageniella it will be remembered was created by Brotherus for a Sikkim species, and the same author added a second species later from Hawaii. It is interesting that two further species should have been collected from Assam.

Acanthocladium penicillatum (Mitt.) Broth.—In forest, 2,700-3,300 m., Piri, Aka Hills; October 1933 (36). Pañkim La, Abor Hills, 1934 (147). Bompur La, Piri, Aka Hills, 1,800 m., on tree trunk, November 1934 (237). Piri, 2,500 m.; April 1934 (242, 267). Japwo, Naga Hills, 2,700 m.; October-November 1935 (298, 308). Nearly all in fruit. Forming flat, dense patches, closely interwoven.

Acanthocladium tanytrichum (Mont.) Broth.—Bompur La, Piri, Aka Hills, 1,800 m.; November 1934 (237). Piri, 3,000 m.; November 1934 (267d). Both are somewhat off-type.

Acanthocladium baculiferum Dix. sp. nov. (Pl. I, fig. 20).

Caulis prostratus, densissime pinnatus atque fasciculato-ramosus, ramis erectis, iterumque ramulosus, ramulis parvifoliis, strictis, gracilibus, baculiformibus. Folia caulina parva, e basi vix contracta, oblongo-ovata, concava, breviter acutata, integra, ecostata. Cellulae parvae, angustissimae, lineares, parietibus incrassatis; basilares flavidae, perincrassatae, alares utrinque circa 3, magnae, vesiculosae, aurantiacae, supra-alares sat numerosae, parvae, sub-

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quadratae, hyalinae. Folia ramea breviora, latiora, saepe subdenticulata; ramulina erecta, conferta, angustiora, minora, integra. Cetera ignota.

Hab. Japwo, Naga Hills, 2,750 m.; 27 November 1935 (309).

A peculiar plant, possibly belonging to Acroporium, but recognizable at once by the densely pinnate and fastigiate branching, with very numerous slender rod-like branchlets; by the short, broad leaves, only rarely with a few obtuse apical teeth.

Giammella pterogonioides (Griff.) Broth.—Shillong, 1,600 m.; September 1934 (199), c. fr. The peristome is a little longer than as figured by Brotherus, and this is also the case with specimens at Kew. The lowest alar cells are sometimes short, but sometimes distinctly elongate.

Chionostomum rostratum (Griff.) C.M.—Shillong, 1,600 m.; September 1934 (189, 195).

Foreauella orthothecia (Schwaegr.) Dix. & Varde (*Foreauella indica* Dix. & varde; *Hypnum orthothecium* Schwaegr. On *Litora* Bhassiana, Satai, 200 m.; August 1934 (179), c. fr.

For the synonymy of this plant see *Journ. of Bot.*, 1937, p. 129.

Brotherella erythrocaulis (Mitt.) Fleisch.—Pankim La, Abor Hills, 1934 (135).

Brotherella ambylostega (Mitt.) Broth.—In forest, 2,700-3,300 m., Piri, Aka Hills; October 1933 (32). Japwo, Naga Hills, 2,750-3,300 m.; December 1935 (335).

Brotherella filiformis Dix. sp. nov.

Gracilis, habitu fere *Hypni cupressiformis* var. *filiformis;* arcte, late caespitosa, pallide viridis. Caulis dense pinnatus, ramis parallelibus, filiformibus, strictiusculis. Folia parva, vix 1 mm. longa, regulariter falcato-decurva, e basi ovali concava, raptim angustissime acuminata, acumine basi subaequilongo, falcato, subpilifero, denticulato. Costa subnulla. Margines plani, vel apud basin leniter explicati. Cellulae perpellucidae, angustae, basilares flavae, alares paucae, vesiculosae, hyalinae, flavidae, majusculae.

Bracteae perichaetii suberectae, acumine elongato, subulato, leniter flexuoso, argute denticulato. Seta circa 1 cm. longa, infra thecam arcuata, unde theca inclinata, deoperculata circa 2 mm. longa, e collo brevi curvato subcylindrica, leniter curvata, fusca, infra orificium leniter contracta. Operculum acute rostellatum.

Hab. Japwo, Naga Hills, 2,750 m.; October 1935 (304), type. Ibidem (302). Ibidem, 2,600 m.; 27 October (321). Purobami, Naga Hills, 2,300 m.; 28 October 1935 (360), forma robustior.

Very near to *B. lepida* (Mitt.), but differing in the more slender habit, straight, narrow branches, more falcate, smaller leaves very abruptly narrowed to a longer, subpiliferous subula. *B. Harveyana* (Mitt.) has less falcate leaves and quite symmetrical, not curved capsule.

Brotherela falcata (Doz. & Molk.) Fleisch.—Piri, Aka Hills, 3,000 m.; November 1934 (261c).

Meiothecium microcarpum (Harv.) Mitt.—On bark, Charduar; August 1934 (172).

Sematophyllum caespitosum (Sw.) Mitt.—Shillong, 1,400 m.; 1934 (166).

Trichosteleum hamatum (Doz. & Molk.) Jaeg—On a rock, Bompur La, Aka Hills, 1,850 m.; November 1934 (231). A pale green form, with leaves less strongly falcate than usual, and coarse papillae; the seta very rough in the upper half.

Trichosteleum Boschii (Doz. & Molk.) Jaeg.—Fallen tree, Dharibati, 100 m.; November 1934 (209). A rather striking form, the leaves with quite short points. The papillae are high, not conical but cylindric, often especially so on the perichaetial bracts. The capsule is slightly mamillose.

Taxithelium kerianum (Broth.) Broth.—Balipara Frontier Tract, foot of Aka Hills; November-December 1933 (65).

Taxithelium laeviusculum Dix. sp. nov.

Dense, late, humillime caespitosum, laete virens, nitidum, gracile. Caulis brevis, pinnatus, ramis brevibus, complanatis. Folia complanata, patentia,

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leniter decurvo-falcata, e basi parum contracta, asymmetrica, lanceolata, breviter acuminata. Margines plani vel hic illic angustissime recurvi, superne denticulati. Cellulae angustae, lineari-rhomboideae, plerumque laeves, raro perindistincte humillime seriato-papillosae; basilares seriebus circa 2 laxae, hyalinae, alares vix distinctae. Costa bina, plerumque bene evoluta, circa tertiam partem folii attingens.

Autoicum. Perichaetium majusculum, bracteis patulis, tenui-acuminatis, denticulatis. Seta circa 1 cm. longa, infra intense purpurea, superne arcuata. Theca parva, curvata (immatura), operculum conicum, apiculatum.

Hab. Him Parbat, 2,000 m.; 21 March 1934 (97).

Except for the very faint seriate papillae which occur at times, this might be an Isopterygium. The habit, however, is like that of some Taxithelia, and I place it here, though with some hesitation. *I. lignicola* (Mitt.) is like it, but has nerveless, entire leaves.

HYPNACEÆ.

Plagiothecium neckeroideum Bry. eur.—Japwo, Naga Hills, 2,750 m.; November 1935 (306), c. fr.

Isopterygium Textori (Lac.) Jaeg.—In forest, 1,700-3,300 m., Piri, Aka Hills, October 1933 (38).

Isopterygium albescens (Schwaegr.) Jaeg. In forest, 1,700-3,300 m., Piri, Aka Hills; October 1933 (25).

Isopterygium pallidum (Mitt.) Jaeg.—On *Ficus elastica*, Charduar; July, 1934 (177).

Hypnum binervosum Dix. sp. nov.

Sat robustum, dense, late caespitosum, pulchre aureum. Caulis sat regulariter pinnatus, ramis 3-4 mm. longis. Folia regulariter aequaliter disposita, fortiter circinata, circa 1.5 mm. longa, ad insertionem haud contracta, oblongo-lanceolata, longe tenui-acuminata, integra, marginibus planis. Costa plerumque duplex, cruribus duobus parallelis, validiusculis, alte in lamina prolongatis. Cellulae angustissimae, ad basin parum laxiores, tantum infra insertionem serie transversali majores, hyalinae; alares O.

Dioicum. Perichaetium conspicuum, vagina longa, magna; bracteae membranaceae, albidae, tenerae, e basi erecta breviter loriformiter reflexae, leniter denticulatae. Seta intense purpurea, 1 cm. alta (immatura), calyptra alba nitidiuscula. Theca haud visa.

Hab. Japwo, Naga Hills, 2,750-3,300 m.; 7 December 1935 (329).

A very pretty species in the golden colouring and the very regular, circinate foliation, as well as in the nerves, usually composed of two parallel branches, not united at the base, and often reaching quite high in the leaf base.

Ectropothecium buitenzorgii (Bél.) Jaeg.—Tako Senyak, Dafla Hills, 1,400 m.; March 1934 (110), c. fr.

Ectropothecium cyperoides (Hook.) Jaeg.—Naga Hills; 1935 (279).

Ectropothecium dealbatum (Hornsch. & Reinw.) Jaeg.—Balipara Frontier Tract, foot of Aka Hills; November-December 1933 (47, 62), c. fr.

Ectropothecium ramuligerum Dix. sp. nov.

E. Zollingeri (Bry. jav.) affine. Atro-viridis, late humillime expansum, haud nitidum. Caulis vage ramosus, ramis percomplanatis, tenuibus, inaequalibus, attenuatis, saepe ramulos microphyllos plus minusve elongatos sparsos emittentibus. Cellulae angustae, subconflatae, basilares paullo laxiores, breviores, sensim in alares parvas, breviter rectangulares vix notatas transeuntes. Folia sat laxa, complanata, asymmetrica, lanceolata, leniter cultriformia, breviter acute acuminata, denticulata, subecostata.

Autoicum. Bracteae perichaetii paucae, sat parvae, breviter late acuminatae, subdenticulatae. Seta circa 1 cm. vel paullo ultra, atropurpurea, laevis, apice arcuato. Theca subpendula, e collo subaequilongo oblonga, atrofusca, sub ore contracta.

Hab. Balipara Frontier Tract, foot of Aka Hills, 100-300 m.; November-December 1933 (43).

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Allied to *E. Zollingeri,* but autoicous, with more narrowly acuminate, denticulate leaves, and small perichaetium. The microphyllous ramuli seem characteristic.

In the autoicous inflorescence it is near *Glossadelphus amboinensis* Fleischer, but from the description that is a smaller plant, with oval, acute, not acuminate leaves, and a longer seta.

Vesicularia reticulata (Doz. & Molk.) Broth.—In forest, 1,700-3,300 m., Piri, Aka Hills; October 1933 (15). Satai, on a bank; August 1934 (175). Khüvubhu, Naga Hills, 1,500 m.; November 1935 (345).

Hylocomiaceæ.

Ctenidium lychnites (Mitt.) Broth.—Japwo, Naga Hills, 2,750 m.; October 1935 (301).

Leptohymenium tenue (Hook.) Schwaegr.—Japwo, Naga Hills, 2,700-3,300 m.; December 1935 (325, 327). Ibidem, 2,700 m.; October 1935 (319). A form with narrow capsules, branches very little curved when dry, deep orange brown leaves, rather widely spreading when dry.

Macrothamnium submacrocarpum (Hampe) Fleisch.—Several gatherings.

Macrothamnium macrocarpum (Reinw. & Hornsch.) Fleisch.—Several gatherings.

Leiodontium complanatum Dix. sp. nov. (Pl. I, fig. 16).

Pusillum. Corticola, dense caespitosum, humile, pallide viride, haud nitens, Caulis conferte, complanate, stricte pinnatim brevissime ramosús; rami paucos mm. longi, saepe iterum ramulosi; interdum inter folia superiora fila articulata sat numerosa axillaria, inaequalia, laevia emittentes; gemmae fuscae sphaericae circa 50 μ latae, laeves, indivisae, brevissime stipitatae, singulae in foliorum axillis paucae inveniuntur. Folia ovata vel ovato-lanceolata, minuta, .3-.4 mm. longa, breviter, subacute vel obtuse acutata, ecostata, minute crenulata, vel denticulata; cellulae breviter rhomboideae, variabiles, 3 × 1-6 × 1, marginales breviores, alares sat numerosae, subquadratae, alas parvas sed bene notatas saepe coloratas instruentes.

Bracteae perichaetii breves, late acutatae, nunc subintegrae nunc argute denticulatae. Seta 1 cm. longa, tenuissima; theca erecta, elliptica, minuta, 1 mm. longa; operculum oblique rostellatum; exothecii cellulae laxae, hexagonae, longitudinaliter seriatae, parietibus tenuibus. Annulus O. Spori 13-20 μ, saturate virides. Peristomium pallidum; dentes ad basin arcte conjuncti, laeves, pellucidi, sed solidi, lamellis intus valde prominentibus. Endostomium imperfectum, processus ad dentes adhaerentes.

Hab. Japwo, Naga Hills, 2,400 m.; October 1935 (314), type. Chingku, Naga Hills, 2,450 m.; 5 November 1935 (359).

No. 359 has a slightly different habit, with rather more narrowly pointed leaves, but is otherwise identical.

It is unusual to find a moss bearing two distinct forms of gemmae and at the same time fruiting.

The genus was founded by Brotherus in 1929 for two species of moss collected by Handel-Mazzetti in N. W. Yünnan. The present plant is smaller and very different in the complanate habit, and the leaf form and structure, but the fruiting characters are identical, except that the outer teeth are not perforate here, and the inner are very poorly developed. Brotherus describes the alar cells not differentiated in *L. gracile,* but I find them frequently in the Yünnan plant showing a small but distinct group of laxer, hyaline alar cells, sometimes reaching an appreciable distance up the margin.

I have referred to the curious resemblance between this plant and *Hageniella isopterygioides* under that species.

The Genus Leiodontium is allied to Microctenidium Fleisch.

Polytrichaceæ.

Atrichum obtusulum C.M.—Paona, Naga Hills, 2,150 m.; September 1935 (282). Japwo, Naga Hills, 2,450 m.; October 1935 (317).

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Atrichum pallidum Ren. & Card.—In forest, 2,700-3,300 m., Piri, Aka Hills; October 1933 (34).

Pogonatum contortum (Menz.) Lesq. nov. var. **robustum** Dix. Omnibus partibus majus. Folia 1.25-1.5 cm. longa, dense, argute dentata; folii basis longior, cellulis magis elongatis. Seta longior, theca major, longior, 8 mm. longa.

Hab. In forest, 2,700-3,300 m., Piri, Aka Hills; October 1933 (8).

This extends the distribution of the species westwards considerably.

Pogonatum proliferum (Mitt.) Jaeg—On *Ficus elastica*, Chardura; July, 1935 (350).

Pogonatum papillosulum(Griff.) Mitt.—Chingku, Naga Hills, 2,600 m.; November to December 1933 (60). Shillong, 1,400 m.; September 1934 (170, 181, 197). 181, 197).

Pogonotum microstomum (R. Br.) Brid.—Dozeppe, Naga Hills; August 1935 (295).

Explanation of plate.

1. *Brothera capillifolia.* a, deciduous leaf, ×5.
2. *Syrrhopodon pilulifer.* a, leaf, ×20.
3. *Pseudosymblepharis pallidens.* a, leaf, ×20, b, peristome, ×20.
4. *Ptychomitrium rhacomitrioides.* a, basal areolation, ×40.
5. *Macromitrium Rigbyanum.* a, capsule, ×3.
6. *Jaegerinopsis intergrifolia.* a plant, ×1. b, leaf, ×10.
7. *Symphysodontella Borii.* a, leaf, ×10.
8. *Symphysodontella pilifolia.* a, leaf, ×10.
9. *Symphysodontella tortifolia.* a, stem leaf, ×10. b, leaf apex, ×20.
10. *Pterobryopsis auriculata.* a, leaf, ×10.
11. *Lindigia asiatica.* a, plant, ×1. b, leaf, ×10.
12. *Handeliobryum assamicum.* a, leaf, ×10.
13. *Daltonia perlaxiretis.* a, leaf, ×10. b, upper marginal cells, ×100.
14. *Daltonia gemmipara.* a, leaf, ×10. b, gemmae, ×10.
15. *Ortholimnobium Borii.* a, plant, ×1. b, leaf, ×10. c, capsule, ×12.
16. *Leiodontium complanatum.* a, plant, ×2. b, leaves, ×20. c, alar cells, ×80. d, capsule, ×12.
17. *Aptychella Borii.* a, leaf, ×10.
18. *Hageniella isopterygioides.* a, leaf, ×20. b, alar cells, ×80.
19. *Hageniella assamica.* a, leaf, ×20.
20. *Acanthocladium baculiferum.* a, part of stem, ×1. b, leaf, ×10.

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SOME DATA ON THE FAUNA: BLATTODEA, MANTODEA, PHASMODEA AND ORTHOPTERA OF NORTH AFGHANISTAN.

BY

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(*With 6 text-figures*).

The present paper is the result of a study of the collections made in North Afghanistan by N. N. Umnov in 1930 and by V. A. Maximov in the years 1930-31.

The records of *Blattodea*, *Mantodea* and *Orthoptera* of Afghanistan, up to the present time published by several authors, have been included into the paper in order to elucidate the fauna of the country which is still very little studied.

The present list comprises: 6 *Blattodea*; 10 *Mantodea*; 1 *Phasmodea* and 57 *Orthoptera*, the last order containing: 3 *Tettigonioidea* 6 *Gryllodea* and 48 *Acridodea*. As compared with what was known from literature, our knowledge is now more complete. Several species are recorded for the first time, namely: 2 *Blattodea*, 4 *Mantodea*, 1 *Phasmodea* and 36 *Orthoptera* (3 *Tettigonioidea*, 4 *Gryllodea*, 29 *Acridodea*. Among the members of the last suborder five species new to science have been found.

The holotypes and allotypes of these new species are preserved at the Zoological Institute of the Academy of Sciences, Leningrad.

The author feels it his pleasant duty to express his sincere thanks to Dr. B. P. Uvarov, who kindly sent me for study valuable material and for his kind assistance in the preparation of my paper; to Dr. E. F. Miram, curator of *Orthoptera* in the Zoological Institute of the Academy of Sciences in Leningrad, for her permission to examine the small but very interesting collection of N. N. Umnov; to Dr. S. A. Predtetshensky, senior entomologist of the Institute for Plant Protection in Leningrad for his valuable directions and for the communication of his unpublished records; to Mr. V. A. Maximov, who has kindly placed at the author's disposal his collection.

BLATTODEA

***1. Polyphaga saussurei** (Dohrn), 1888.[1]
Gurimar, 19-8-1930, 1 ♂, 2 ♀♀, 4 larvae (Maximov).

2. Polyphaga camelorum Kirby, 1903.
Kirby (1889) has recorded this species from Hari-Rud valley under the name *Polyphaga sp.* and Chopard (1929) has recorded it from Badghis.

[1] Species marked with a small asterisk are recorded from Afghanistan for the first time.

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3. Polyphaga obscura Chopard, 1929.
This species has been described by Chopard (1929) from Paghman near Kabul.

4. Anisogamia tamerlana Saussure, 1893.
Recorded from Afghanistan by Brancsik (1897).

5. Heterogamodes roseni (Brancsik), 1897.
This species has been described by Brancisk (1897) from Afghanistan, without exact indication of locality, under the name *Heterogamia roseni* Branc.

***6. Phyllodromica irinae** (Bey-Bienko), 1932.
Ak-Tepe, 27-7-1931. 1 ♀ (Maximov).

MANTODEA

7. Eremiaphila arabica Saussure, 1871.
Kirby (1894) has recorded this species from between Khusan and Quetta.

***8. Armene pusilla** (Eversmann), 1854.
Gurimar, 19-8-1930, 1 ♀ (Maximov).

9. Hierodula transcaucasica Brunner von Wattenwyl, 1878.
Gurimar, 19-8-1930, 1 ♀ (Maximov).
Recorded by Kirby (1889) from Afghanistan under the name *Hierodula robusta* Saussure?

10. Mantis religiosa (Linnaeus), 1758.
Kirby (189) has recorded this species from Afghanistan, without exact indication of locality.

***11. Oxythespis wagneri** (Kittary), 1849.
Kazan, 14-8-1930, 1 ♂, 2 ♀♀ (Maximov).

***12. Iris oratoria polystictica** (Fischer de Waldheim), 1846.
Ak-Tepe, 17-71931, 3 ♂♂, 1 ♀ (Maximov).

13. Iris splendida Uvarov, 1922
This species has been described by Uvarov (1922) from Afghanistan, without exact indication of locality.

14. Rivetina baetica (Rambur), 1839.
Gurimar, 19-8-1930, 1 ♂, 2 ♀♀; Ak-Tepe, 27-7-1931, 5 ♂♂ (Maximov).
Kirby (189) has recorded this species from Hari-Rud valley under the name *Polyspilota striata* Stoll, while Jacobson and Bianchi (1902-1905) put it under the name *Polyspilota æruginosa* Goeze.

***15. Empusa pennicornis** (Pallas), 1773.
Man-guzar, 16-8-1930, 3 ♀♀; Ak-Tepe, 27-7-1931, 1 ♂ (Maximov).

16. Blepharopsis mendica nuda Giglio-Tos, 1917.
Kirby (1889) has recorded this species from Afghanistan, without exact indication of locality, under the name *Belpharis mendica* Fabricius.

PHASMODEA

17. Gratidia adelungi Brunner von Wattenwyl, 1908.
Kazan, 11-8-1930, 1 ♀ (Maximov).
♀ (nova). Body large, nearly smooth.
Head elongated, with indistinct longitudinal keels, with two very distinct acute projections between eyes; median keel distinct, reaching to the occiput. Occiput with two tubercles. Eyes round. Antennae moderately thick, 17 jointed, a little longer than head and pronotum together.
Pronotum anteriorly feebly constricted, short, its length nearly 1.5 times as long as maximum width; its surface with distinct longitudinal folds, behind the middle with distinct transverse depression. Mesonotum long, anteriorly somewhat narrowed. Metanotum considerably shorter than mesonotum, parallel-sided. Mesonotum and metanotum with distinct median keel, their surface finely and very densely punctured, with sparse granulae.
Sternum finely and densely punctured, with indistinct granulae. Abdomen with distinct median keel, finely and densely punctured and with indistinct

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granulae, on each side with indistinct lateral keels. Apex of the subgenital plate shortly-triangular.

General coloration brownish-white.

—	♀
Length of the body ...	89·5 mm.
,, of the antennæ ...	9·5 ,,
,, of the pronotum ...	2·9 ,,
,, of the mesonotum ...	17·5 ,,
,, of the metanotum ...	14 3 ,,
,, of the anterior femora ...	17·5 ,,
,, of the middle femora ...	17·5 ,,
,, of the hind femora ...	24·0 ,,

ORTHOPTERA

Tettigonioidea

***18. Conocephalus buxtoni** Chopard, 1921.
Mouth of the river Kunduz-Daria, 29-7-1931, 2 ♂♂, 1 ♀ (Maximov).

***19. Metrioptera tamerlana** (Saussure), 1874.
Mouth of the river Kunduz-Daria, 29-7-1931, 9 ♂♂, 7 ♀♀ (Maximov).

***20. Decticus albifrons** (Fabricius), 1775.
Ak-Tepe, 27, vii., ♂♂, 5 ♀♀; Mouth of the river Kunduz-Daria, 29-7-1931, 1 ♀ (Maximov).

Gryllodea

21. Gryllotalpa africana (P. Beauvois), 1805.
Kirby (1889) has recorded this species from Hari-Rud valley under the name *Acheta africana* P. Beauv.

22. Gryllus bimaculatus (De Geer), 1773.
Ak-Tepe 27-7-1931, 2 ♀♀ (Maximov).
Kirby (1889) has recorded probably this species from between Khusan and Quetta under the name *Gryllus capensis* Fabr.

***23. Gryllulus tartarus** (Saussure), 1874.
Mouth of the river Kunduz-Daria, 29-7-1931, 11 ♂♂ 13 ♀♀ (Maximov).

***24. Gryllulus chinensis** (Weber), 1801.
Ak-Tepe, 27-7-1931, 3 ♂♂, 1 ♀ (Maximov).

***25. Gryllulus bucharicus** (Bey-Bienko), 1933.
Mouth of the river Kunduz-Daria, 29-7-1931, 2 ♂♂, (Maximov).

***26. Pteronemobius heydenii concolor** (Walker), 1871.
Mouth of the river Kunduz-Daria, 29-7-1931, 1 ♂, 4 ♀♀ (Maximov).

Acridodea

27. Acrida deserti Uvarov, 1916.
Man-Guzar, 16-8-1930, 7 ♂♂, 4 ♀♀; Ak-Tepe, 27-7-1931, 5 ♂♂, 1 ♀ (Maximov).
Tarbinsky (1926) has recorded this insect for Mazar-i-Sherif under the name *Acrida turrita deserti* Uvarov, but Miram (1935) regards it as a good species.

28. Acridella nasuta (Linnaeus), 1758.
Man-Guzar, 16-8-1930, 2 ♂♂, 1 ♀ (Maximov).
Probably this species has been recorded by Kirby (1889), under the name *Acrida grandis* Klug? from between Khusan and Quetta.

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***29. Gonista sagitta** (Uvarov), 1912.
Mouth of the river Kunduz-Daria, 29-7-1931, 1 ♀ (Maximov).

***30. Platypterna mistshenkoi** Bey-Bienko, 1936.
Kazan, 11-8-1930, 2 ♂♂, 1 ♀ (Maximov).

***31. Duroniella kalmyka** (Adelung), 1906.
Mouth of the river Kunduz-Daria, 29-7-1931, 9 ♂♂, 7 ♀♀ (Maximov).

32. Dociostaurus maroccanus (Thunberg), 1815.
Kazan, 11-8-1930, 1 ♂, 3 ♀♀; Ak-Tepe, 27-7-1931, 7 ♂♂, 3 ♀♀ (Maximov).
Kirby (1889) has recorded this species from Badghis, under the name *Stauronotus maroccanus* Thunb.

***33. Dociostaurus tartarus** (Stshelkanovtzev), 1909.
Guriamar, 19-81930, 1 ♂, 1 ♀; Ak-Tepe, 27-7-1931, 1 ♂, 6 ♀♀ (Maximov).

***34. Notostaurus albicornis albicornis** (Eversmann), 1847.
Kara-bel, 28-6-1930, 2 ♂♂ (Umnov); Gurimar, 19-8-1930, 1 ♂ (Maximov).
All species belong to the typical race but are characterized by smaller dimensions of the body:

	♂♂
Length of the body	10·5—12·8 mm.
,, of the pronotum	2·2— 2·7 ,,
,, of the elytra	5·9— 7·1 ,,
,, of the hind femora ...	7·1— 8·3 ,,
,, of the hind tibiæ	5·9— 7·1 ,,

***35. Mizonocara uvarovi** Bey Bienko, 1933.
Ak-Tepe, 27-7-1931, 1 ♂ (Maximov).

***36 Aiolopus affinis** (T. Bolivar), 1902.
Mouth of the river Kunduz-Daria, 29-7-1931, 4 ♂♂, 2 ♀♀ (Maximov).

37. Aiolopus thalassinus (Fabricius), 1781.
Mouth of the river Kunduz-Daria, 29-7-1931, 17 ♂♂, 7 ♀♀ (Maximov).
Redtenbacher (1900) has recorded this species from Afghanistan, without exact indication of locality, under the name *Epacromia tergestina* Charp.

***38. Aiolopus oxianus** Uvarov, 1926.
Mouth of the river Kunduz-Daria, 29-7-1931, 5 ♂♂, 1 ♀ (Maximov).

39. Locusta migratoria migratoria (Linnaeus), 1758, **ph. solitaria.**
Mouth of the river Kunduz-Daria, 29-7-1931, 6 ♂♂, 7 ♀♀, 3lv, 3liv (Maximov).
Kirby (1889) has recorded this species from Afghanistan (from between Khusan and Quetta) under the name *Locusta danica* Linn.

***40. Œdaleus senegalensis** (Krauss), 1877.
Man-Guzar, 16-8-1930, 3 ♂♂, 4 ♀♀ (Maximov).

***41. Mioscirtus wagneri** (Eversmann), 1859.
1859. *Œdipoda wagneri* Eversmann, *Bull. Soc. Imp. Nat. Mosc.*, vol. xxxii. No. 1, pp. 145-6, pl. I, fig. 3 [Type ♀; steppe between Volga and Ural]
1884. *S[cintharista] wagneri* Saussure, Mem. Soc. Phys. Hist. Nat. Gen., vol. xxxviii. No. 9, pp. 121-2, no. 3.
188. *C[onozoa] rogenhoferi* Saussure, Mem. Soc. Phys. Hist. Nat. Gen., vol. xxx. No. 1, pp. 60-61, no. 5, fig. 4 [type ♀; Baghdad].
1896. *Mioscirtus varentzzowi*, Zubowsky, Hor. Soc. Ent. Ross, vol. xxx. pp. 186-7, no. 12, [type ♀; Kopet-Dagh. Firjuza].
1922. *Mioscirtus wagneri rogenhoferi* Uvarov, *Journ. Bom. Nat. His. Soc.* vol. xxxiii. No. 3, p. 361, no. 29.
Man-Guzar, 16-8-1930, 14, ♂♂, 15 ♀♀ (Maximov).

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The above synonymy has been established by S. A. Predtetshensky in his as yet unpublished work on *Acridodea* of Badghis.

The comparative dimensions of the Afghan and the Lower Volga specimens are given in the following table:

	Afghan specimens		L. Volga specimens (after Predtetshensky)	
	♂♂	♀♀	♂♂	♀♀
Length of the body	14·5–15·0 mm	22·5–28·5 mm	12·0–16·0 mm	17·0–25·0 mm
,, of the pronotum	3·1– 3·2 ,,	4·4– 5·9 ,,	2·6– 3·2 ,,	3·7– 5·0 ,,
,, of the elytra	13·5–17·0 ,,	21·0–28·0 ,,	11·4–15·1 ,,	16·8–22·0 ,,
,, of the hind femora	8·8– 9·6 ,,	11·8–15·4 ,,	7·8– 9·0 ,,	10·5–12·8 ,,
,, of the hind tibiæ.	8·0– 8·8 ,,	11·0–14·6 ,,	...	...

***42. Acrotylus insubricus** (Scopoli), 1786.
Mouth of the river Kunduz-Daria, 29-7-1931, 3 ♂♂ (Maximov).

***43. Sphingonotus savignyi** Saussure, 1884.
Kazan, 11-8-1930, 2 ♀♀ (Maximov).

44. Sphingonotus afghanicus Mistshenko, 1936.
This species has been described by Mistshenko (1936) from Barazendan.

***45. Sphingonotus nebulosus discolor** Uvarov, 1933.
Ak-Tepe, 27-7-1931, 2 ♂♂, 1 ♀ (Maximov).

46. Sphingonotus longipennis Saussure, 1884.
Recorded from Afghanistan (Parachinor, Kuran) by Uvarov (1925).

***47. Sphingonotus obscuratus brunneri** Saussure, 1884.
Ak-Tepe, 27-7-1931, 1 ♂, 1 ♀ (Maximov).

48. Sphingonotus octofasciatus (Serville), 1839.
Recorded from Afghanistan by *Kirby* (1889) under the name *Spingonotus kittaryi* Saussure?, without exact indication of locality.

***49. Helioscirtus moseri moseri** Saussure, 1884.
Ak-Tepe, 27-7-1931, 3 ♂♂, 1 ♀ (Maximov).

***50. Leptopternis gracilis** (Eversmann), 1847.
Kazan, 11-8-1930, 5 ♂♂, 2 ♀♀ (Maximov).

51. Hyalorrhipis turcmena Uvarov, 1926.
Kazan, 11-8-1930, 2 ♀♀ (Maximov).
Jacobson and Bianchi (1902-5) recorded from Afghanistan also *Hyalorrhipis clausi* Kittary, Dr. Aitchison being referred to as collector, but there is no such record in Kirby's report (1889) on his collection and Dr. B. P. Uvarov informs me that there are no specimens in Aitchison's material in the British Museum.

52. Iranella eremiaphila Uvarov, 1922.
Recorded by *Uvarov* (1933) from Afghanistan, without exact indication of locality.

53. Strumiger desertorum persa Uvarov, 1933.
Kazan, 11-8-1930, 1 ♀ (Maximov).
A species recorded by *Kirby* (1889) with a mark of interrogation from Hari-Rud valley, under the name *Thrinchus campanulatus* F.-W. is a species of *Thrinchus* in poor condition and cannot be determined according to Dr. B. P. Uvarov who has examined it.

54. Eremocharis afghana Ramme, 1928.
This species has been described by Ramme (1928) from Kabul.

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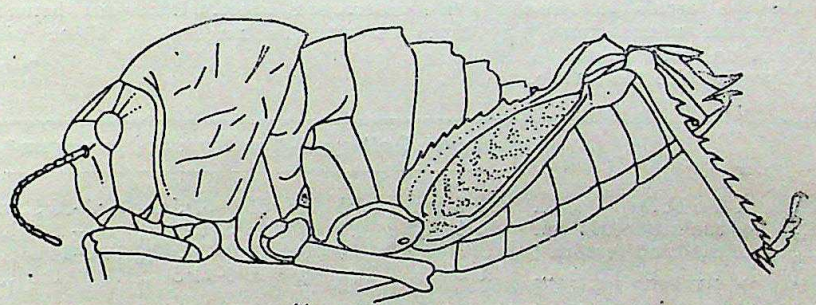
55. Tropidauchen sp. n.

Recorded by Kirby (1889) from Badghis and the Hari-Rud valley under the name *Eunapius granosus* Stål, and Uvarov (1922) put it under the name *Tropidauchen cultricolle* Saussure, while actually it represents an undescribed species as I am able to tell after the examination of the specimens kindly sent to me by Dr. B. P. Uvarov.

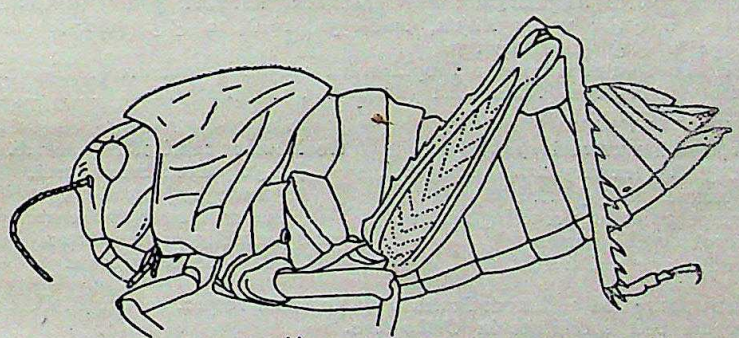
***56. Tropidauchen uvarovi** sp. n. (Figs. 1 U and 2 U).

♀ (holotype). Body strongly rugulose.

Head very rough with sharp granulae, in the posterior part rugulose. Eyes shortly-oval, feebly prominent sidewards; vertical diameter of the eye a little larger than its horizontal diameter and nearly half the length of the interocular space. Face vertical. Frontal ridge very narrow, strongly depressed, under the median ocellum constricted, at the clypeus triangularly expanded and somewhat obliterated; seen in profile wavy, strongly prominent at the antennal bases; its margins thick. Vertex broad, octagonal, strongly depressed, granular, with two very sharp small tubercles at the middle: median keel in the posterior part sharp; its margins sharp and straight. Antennae thick, 15-jointed, far from reaching the posterior margin of the pronotum.



U.



M.

Fig.—1 U. *Tropidauchen uvarovi*, sp. n., type, ♀, xl. 8.
M. *T. miramae*, sp. n., type, ♀, ×18.

Pronotum strongly rugulose with very sharp granulae at the middle; on each side of the median keel with two oblique and very sharp granular holes; seen in profile feebly arched, at the posterior margin slightly excised: posterior angle obtuse, at the middle excised. Lateral lobes of the pronotum strongly rugulose and granular, with three indistinct transverse sulci; anterior margin a little wavy, anterior lower angle obtuse, feebly rounded; posterior margin strongly sinuous, oblique; posterior lower angle obtuse, feebly rounded; lower margin obliquely ascending, wavy.

Mesonotum and metanotum strongly rugulose and granular, with a median keel.

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Sternum sparsely and finely punctured; its length almost 1.5 times as long as maximum width; interspace between lobes of the mesosternum about 1.5 times as wide as long. Processus of the prosternum wedge-shaped, excised in front.

Hind femur sharply-granular, its length 2.9 times as long as maximum width; upper margin with 8 sharp teeth and 1-2 small teeth between them; lower margin smooth, strongly wavy. Hind tibia a little shorter than the hind femur, with 9 spines on the outer and 8 spines on the inner side.

Abdomen with a sharp median keel, seen in profile forming rectangular teeth on the first segments of the abdomen and with triangularly-blunted teeth on the posterior margin of each other segment. Valvae of the ovipositor with blunted points, lower valvae with one large and several small teeth on the outer margin. Posterior margin of the subgenital plate rounded, prominent.

General coloration grayish-whitish. Apical part of the antennae brownish. Tibiae of the front and middle legs orange-reddish. Hind femora yellow inside; lower margin yellow; middle of the apex black both outside and inside. Hind tibiae red inside, yellow-orange outside; spines yellow with black apex; tarsi red inside, orange outside.

♂ (allotype.) Like the female, but considerably smaller. Vertical diameter of the eye equals to two-thirds the interocular space. Interspace between lobes of the mesosternum 1.25 times as wide as long. Hind tibiae with 9 spines on both sides.

Coloration like the female.

	holotype ♀	allotype ♂	paratypes ♀♀	paratypes ♂♂
Length of the body ...	52·5 mm	35·6 mm	53·5-67·5mm	29·8-36·5mm
,, of the pronotum ...	14·4 ,,	9·7 ,,	13·5-15·8 ,,	8·2- 9·2 ,,
,, of the hind femora .	20·0 ,,	15·0 ,,	20·0-22·5 ,,	13·0-14·8 ,,
,, of the hind tibiæ ...	19·0 ,,	14·0 ,,	19·0-21·5 ,,	12·0-13·8 ,,

Patria. North Afghanistan: settl. Norbeck, 16-22 vi, 3 ♀♀ (including the holotype), 2 ♂♂; valley Ailjak, 26-6-1930, 1 ♀, 2 ♂♂ (Umnov); Abdan, 26-8-1930, 2 ♂♂ (Maximov).

This new species is near to *Tropidauchen cultricolle* Saussure (1881), described by that author from Ashkhabad (Turkmenistan), but differs from it by the following characters:

Tropidauchen uvarovi sp.n.
♀, ♂. Vertex very broad, octagonal.
Antennae 14-15-jointed.
Pronotum slightly covering the head, not reaching the vertex.
Hind tibiae red inside.

Tropidauchen cultricolle Saussure.
♀, ♂. Vertex broad, oval.
Antennae 17-jointed.
Pronotum strongly covering the head, reaching to the vertex.
Hind tibiae blue inside.

This species the author dedicates with profound respect to Dr. B. P. Uvarov. one of the best specialists in *Orthoptera*.

***57. Tropidauchen miramæ** sp. n. (Figs. 1 M and 2 M).

♀ (Holotype). Body somewhat rough.

Head in the posterior part slightly rugulose, sparsely punctured, nearly smooth. Eyes shortly-oval, slightly prominent sidewards; vertical diameter of the eye a little larger than the horizontal diameter and equals to two-thirds of the interocular space. Face vertical. Frontal ridge narrow, strongly depressed, nearly parallel-sided, triangularly-divergent at the clypeus and somewhat obliterated; seen in profile wavy, strongly prominent at the antennal bases; its margins thick. Vertex narrow, long, oval, strongly depressed, granular; median keel in the posterior part of the vertex distinct. Antennae thick, 18-jointed, not reaching the posterior margin of the pronotum.

Pronotum slightly rugulose, but sharply granular at the middle; on each side of the median keel with two oblique sharply-granular folds; seen in profile feebly arched, somewhat wavy; posterior angle obtuse, at the middle

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excised. Lateral lobes of the pronotum slightly rugulose, but sharply granular, with three indistinct transverse sulci, at the middle with a longitudinal smooth fold; anterior margin wavy, vertical, anterior lower angle obtuse, feebly rounded; posterior margin wavy, oblique, posterior lower angle obtuse, rounded; lower margin obliquely ascending, wavy.

Mesonotum and metanotum slightly rugulose and sharply granular, with a median keel.

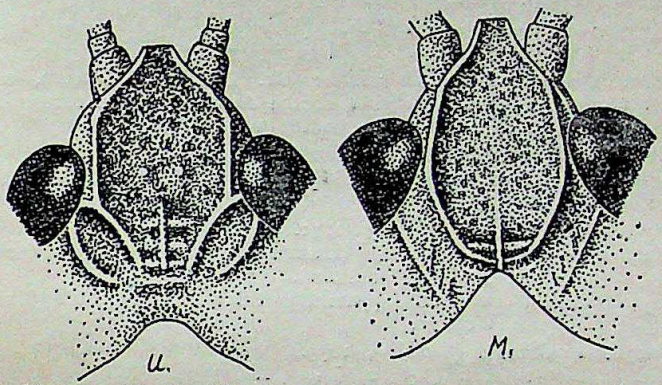

Fig. 2.—U. *Tropidauchen uvarovi*, sp. n., allotype, ♂, vertex.—M. *T. miramae*, sp. n., allotype, ♂.

Sternum sparsely and finely punctured; its length nearly 1.5 times as long as maximum width; interspace between lobes of the mesosternum scarcely wider than long. Processus of the prosternum narrow, wedge-shaped; its apex feebly excised.

Hind femur smooth, its length 3.3 times as long as maximum width; upper margin with 9 small teeth; lower margin smooth, wavy. Hind tibia a little shorter than hind femur, with 9 spines on both sides.

Abdomen with a sharp median keel, seen in profile forming small triangularly-blunted teeth at the postreior margin of each segment. Valvae of the ovipositor with blunted points. Lower valvae of the ovipositor with a sharp projection on the outer margin. Posterior margin of the subgenital plate feebly triangularly-prominent.

General coloration brownish-olive. Head whitish. Apical part of the antennae brown. Margins of the pronotum and of its lateral lobes and longitudinal fold of the lobes, whitish. Abdomen below yellowish-white. Hind femur inside yellow; its lower margin and upper margin inside black-blue; middle of apex outside and inside, black. Hind tibiae yellow (in some paratypes violet-rosy); spines yellow with black apex.

♂ (allotype). Like the female, but considerably smaller. Antennae reaching the posterior margin of the pronotum.

Coloration like the female.

	holotype ♀	allotype ♂	paratypes ♀♀	paratypes ♂♂
Length of the body ...	50·5mm	35·6mm	55·5–71·5mm	28·5–36·0mm
,, of the pronotum ...	15·8 ,,	10·5 ,,	16·5–17·2 ,,	9·2–11·0 ,,
,, of the hind femora .	21·7 ,,	16·5 ,,	22·5–24·0 ,,	15·5–16·8 ,,
,, of the hind tibiæ ...	20·7 ,,	15·5 ,,	21·5–23·0 ,,	14·5–15·8 ,,

Patria. North Afghanistan: pass Irghailyk, 14. vi. 1 ♀, 2 ♂♂; settl. Morbek. 16-25. vi, 4 ♀♀ (including the holotype), 2 ♂♂; Mazar-i-Sherif 24. vi, 1 ♂; valley Ailjak, 26-6-1930, 2 ♂♂ (Umnov); pass Ab-dugh, 28-8-1930, 1 ♀ (Maximov).

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This new species is near to *Tropidauchen paramonovi* Dirsh (1927), described by that author from Firuza (Kopet-Dagh, Turkmenistan), but differs from it by the following characters:

Tropidauchen miramae sp. n.	**Tropidauchen paramonovi** Dirsh.
♀, ♂. Body more slender.	♀, ♂. Body more robust.
Vertex more narrowed.	Vertex more broadened.
Pronotum sharply granular.	Pronotum feebly granular.
Processus of the prosternum narrow.	Processus of the prosternum broad.
Hind femur slender; its length 3.3 times its maximum width.	Hind femur robust; its length 2.9 times its maximum width.

This species the author dedicates to Dr. Emilia F. Miram, curator of Orthoptera in the Zoological Institute of the Academy of Sciences, Leningrad, in acknowledgment of her assistance in the work.

58. Chrotogonus homalodemus (Blanchard), 1836.

This species has been recorded by Kirby (1889) with a question mark from between Khusan and Quetta.

59. Pyrgomorpha conica (Olivier), 1791.

Gurimar, 9-7-1930, 1 ♂, 1 ♀ (Umnov); Mouth of the river Kunduz-Daria, 29-7-1931, 1 ♂, 2 ♀♀ (Maximov).

Kirby (1889) has recorded apparently this species from Badghis, as *Pyrgomorpha bispinosa* Walscer.

***60. Derycoris albidula** (Serville), 1839.

Man-Guzar, 16-8-1930, 2 ♂♂, 2 ♀♀ (Maximov).

***61. Oxya fuscovittata** (Marschall), 1835.

Mouth of the river Kunduz-Daria, 29-7-1931, 8 ♂♂, 20 ♀♀, 17 larvae (Maximov).

***62. Diexis gussakovskyi** Miram (in litt.).

Kazan, 11-7-1930, 1. ♀ (Maximov).

63. Conophyma predtetshenskyi sp. n. (Figs. 3A, B, C, D and E).

♂ (holotype). Body of medium size, robust and smooth.

Head not elevated above the level of the pronotum, very sparsely and finely punctured. Eyes nearly round, small, slightly prominent sidewards; vertical diameter of the eye equal to interocular space. Face sloping. Frontal ridge scarcely depressed, smooth, nearly parallel-sided, not reaching the clypeus; seen in profile feebly prominent at the antennal bases; its margins scarcely distinct. Fastigium of the vertex strongly sloping, almost vertical, vertex scarcely depressed, very finely and densely punctured; its margins scarcely distinct; median keel very weak; maximum width of the vertex about two times that of frontal ridge between antennae. Temporal foveolae indistinct. Occiput slightly sloping, finely and densely punctured. Antennae thin, 19-20-jointed, considerably longer than head and pronotum together.

Pronotum in prozona nearly smooth, with three transverse sulci; two anterior sulci shallow, not intersecting the median keel; median keel sharp and intersected only by the third, deep transverse sulcus; lateral keels interrupted and form double set of keels on each side; first keels reach only the first transverse sulcus, convergent; second keels begin on the lateral lobes near the first transverse sulcus and gradually ascending reach the second transverse sulcus, within this area second keels are parallel to the first keels, while further passing along the margin of the pronotum they become parallel to the median keel, reaching to the third transverse sulcus; metazona very short, densely punctured, with hardly marked median keels, its length about one-third that of the prozona; posterior margin straight, very feebly triangularly-excised at the middle. Lateral lobes of the pronotum trapezoidal, somewhat narrowed towards the lower margin, with three transverse sulci, feebly punctured, anterior and posterior margins undulating; lower margin strongly wavy, obliquely-ascending; anterior lower angle obtuse, rounded; posterior lower angle 90°, broadly-rounded.

Mesonotum and metanotum smooth; metanotum with a distinct median and lateral keels.

Sternum sparsely and coarsely punctured, its maximum width almost equal to length; interspace between lobes of the mesosternum about 1.5 times as wide as long.

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Front and middle femora somewhat swollen. Hind femur thick; its length 3·3 times its maximum width. Hind tibia a little shorter than hind femur, with 9 spines on the outer and 8-9 spines on the inner side.

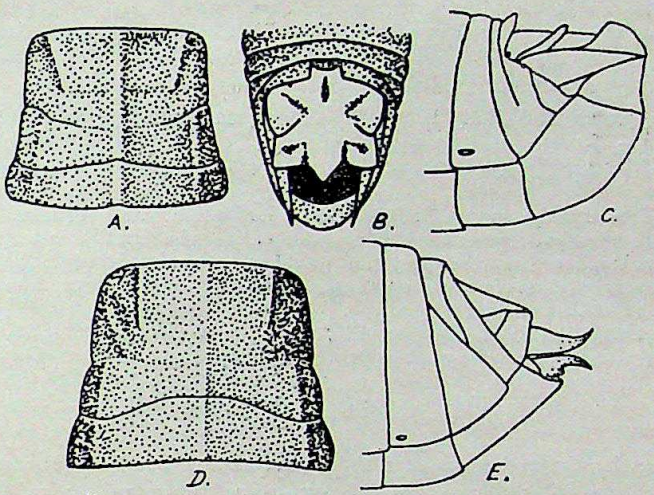

Fig. 3.—*Conophyma predtetshenskyi Sp. n.*

A. Dorsal view of the pronotum of type ♂; B. Dorsal view of the anal plate of type ♂; C. Lateral view of the apex of abdomen of type ♂; D. Dorsal view of the pronotum of allotype ♀; E. Lateral view of the apex of abdomen of allotype ♀; ×7·5.

Abdomen, seen from above, with a median keel; lobes of the last abdominal tergite broad and short, widely separated. Anal plate nearly square, apical part slightly narrowed, posterior angles rounded, posteror margin with a large triangular projection at the middle; its surface at the median longitudinal sulcus convex and with a very sharp triangular projection at each posterior angle. Cercus straight, strongly conical, pointed at the apex; its length about 1.75 times the length of the anal plate.

Head, pronotum and abdomen, seen from above nearly black. Antennae, front and middle legs, hind femora, sternum, head and abdomen, seen from below—dirty-yellow. Hind tibiae orange.

♀ (allotype). Like the male, somewhat larger. Vertical diameter of the eye somewhat less than the interocular space. Frontal ridge obliterate at the clypeus, more depressed than in the male. Vertex with distinct median keel, more depressed than in the male and with distinct elevated margins. Front and middle femora slightly swollen. Hind tibia with 8-9 spines on the outer and on the inner side. Upper and lower valvae of the ovipositor with acute points and a distinct projection on the outer margin. Subgenital plate considerably longer than wide; its posterior angles broadly-rounded; posterior margin with a rather long narrow triangular sharply pointed projection at the middle.

Coloration like the male. Head, pronotum and abdomen, seen from above, dark brownish with black spots.

	holotype ♂	allotype ♀	paratypes ♂♂	paratypes ♀♀
Length of the body.	14·2 mm	16·5 mm	13 0–14·8 mm	15·5–18·5 mm
,, of the pronotum.	2·3 ,,	2·4 ,,	2·1– 2·6 ,,	2·8– 3·1 ,,
,, of the hind femora.	7·5 ,,	7·6 ,,	7·0– 8·0 ,,	8·2– 9·0 ,,
,, of the hind tibiæ.	6·5 ,,	6·6 ,,	6·0– 7·0 ,,	7·2– 8·0 ,,

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Patria. North Afghanistan: Dzhanbulak, 13. vi, 3 ♂♂ (including the holotype), 2 ♀♀; pass Irghailyk, 13. vi, 3 ♂♂, 1 ♀; settl. Norbek, 22. vi, 2 ♂♂; Mazar-i-Sherif, 24-6-1930, 1 ♂, 1 ♀ (Umnov); pass Ab-dugh, 20-8-1930, 1 ♂, 3 ♂♂ (Maximov).

This species is near to *Conophyma ikonnikovi* Uvarov (1925), described by that author from Southern Bokhara (at present Tadjikistan), but differs from it by the following characters:

Conophyma predtetshenskyi sp. n.

♂. Lobes of the last abdominal tergite widely separated.

Anal plate nearly square, slightly narrowed to the apex; posterior angles obtuse; its surface at the posterior angles convex, with a sharp triangular projection at each posterior angle.

Cerci straight, conical; their length almost 1.75 the length of the anal plate.

Conophyma ikonnikovi Uvarov.

♂. Lobes of the last abdominal tergite very feebly separated, almost contiguous.

Anal plate not square, strongly dilated to the apex; posterior angles acute; its surface trough-like, without triangular projection at the posterior angles.

Cerci at the bases constricted, in the apical third, from within, swollen, then strongly pointed; their length almost two times the length of the anal plate.

This species the author dedicats to his first teacher Dr. S. A. Predtetshensky.

*64. **Conophyma bey-bienkoi** sp. n. (Figs. 4A, B, C, D and E).

♂ (holotype). Body of medium size, robust and smooth.

Head not elevated above the level of the pronotum, smooth. Eyes nearly round, slightly prominent sidewards; vertical diameter of the eye equal to

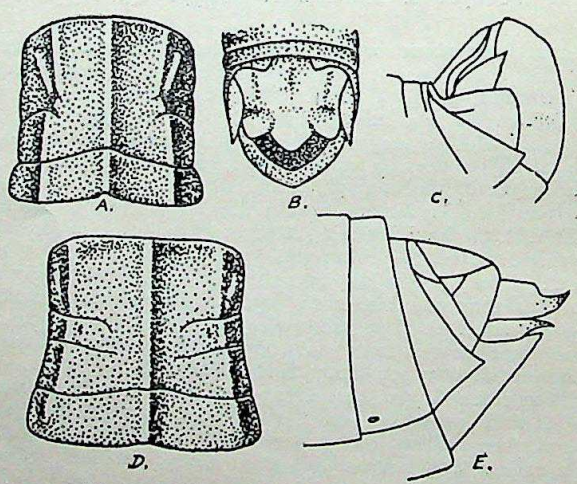

Fig. 4.—*Conophyma bey-bienkoi sp. n.*

A. Dorsal view of the pronotum of type ♂; B. Dorsal view of the anal plate of type ♂; C. Lateral view of the apex of abdomen of type ♂; D. Dorsal view of the pronotum of allotype ♀; E. Lateral view of the paex of abdomen of allotype ♀; ×7.5.

horizontal diameter and nearly equal to interocular space. Face sloping. Frontal ridge slightly depressed, under the median ocellum subconstricted, then dilated and nearly reaching the clypeus; seen in profile feebly prominent at the antennal bases; its margins thick. Fastigium of the vertex strongly sloping, frontal ridge between antennae. Temporal foveolae indistinct. Occiput feebly elevated; median keel absent; maximum width about two times that of the

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frontal ridge between antennae. Temporal foveolae indistinct. Occiput feebly sloping, punctured. Antennae thin, 19-jointed, somewhat longer than head and pronotum together.

Pronotum smooth in the prozona; lateral keels distinct, feebly concave; metazona punctured, its length one-third that of the prozona; median keel in the prozona sharp, intersecting first transverse sulcus, in the metazona indistinct; posterior margin straight very feebly excised in the middle. Lateral lobes of the pronotum trapezoidal, narrowed towards the lower margin, in the posterior part punctured, with three transverse sulci; interspaces between first and second, as well as second and third transverse sulci at the lateral keels of the pronotum slightly rough; anterior and posterior margins undulating; lower margin strongly wavy, obliquely-ascending; anterior lower angle obtuse, rounded; posterior lower angle a little larger than 90°, broadly-rounded.

Mesonotum and metanotum smooth; metanotum with a distinct median and lateral keels.

Sternum very sparsely punctured; its maximum width equal to its length; interspace between lobes of the mesosternum 1.25 times as wide as long.

Front and middle femora swollen. Hind femur thick; its length 3.3 times the maximum width. Hind tibia a little shorter than hind femur, with 9 spines on both sides.

Abdomen, seen from above, with a median keel; lobes of the last abdominal tergite short, broad, widely separated. Anal plate nearly square; lateral margins somewhat excised; posterior angles very sharp, rounded; posterior margin somewhat excised, with a slight triangular projection at the middle; its surface at the middle convex. Cerci conical, pointed at the apex, straight, a little longer than the anal plate.

Head, pronotum and abdomen, seen from above, brownish-blackish with brown spots. Antennae, front and middle legs, hind femora, sternum, head and abdomen, seen from below, tawny. Apical part of the hind tibiae and basal part of the hind femora from within orange-reddish.

♀ (allotype). Like the male, but larger. Subgenital plate considerably longer than wide, posterior angles broadly-rounded, posterior margin with a rather long triangular projection at the middle. Upper and lower valvae of the ovipositor with acute points and projection on the outer margin. Coloration like the male.

	holotype ♂	allotype ♀	paratypes ♂♂	paratypes ♀♀
Length of the body ...	13·0mm.	15·5mm	12·8–14·0mm	16·5–19·8mm
,, of the pronotum ...	2·3 ,,	2·9 ,,	2·1-2·4 ,,	3·6– 3·9 ,,
,, of the hind femora .	7·5 ,,	8·2 ,,	6·5–7·8 ,,	8·5– 9·0 ,,
,, of the hind tibiæ ...	6·5 ,,	7·2 ,,	5·5-6·8 ,,	7·5– 8·0 ,,

Patria. North Afghanistan: pass Irghailyk, 13. vi, 4 ♂♂, 5 ♀♀; Mabar-i-Sherif, 24. vi, 1 ♂; valley Ailjak, 26-6-1930, 2 ♂♂ (including the holotype), 4 ♀♀ (Umnov); pass Ab-dugh, 20-8-1930, 2 ♂♂ (Maximov).

This species is near to *Conophyma sokolowi* Zubovsky (1898), described by that author from environs Tashkent (Uzbekistan), but differs from it by the following characters:

Conophyma bey-bienkoi sp. n.

♂. Median keel of the pronotum slight.

Anal plate nearly square; lateral margins excised; posterior angles very sharp, rounded, prominent sidewards; posterior margin excised.

Conophyma sokolowi Zubovsky.

♂. Median keel of the pronotum sharp.

Anal plate square; lateral margins straight; posterior angles feebly expressed, broadly rounded, not prominent sidewards; posterior margin convex.

This species the author dedicates to Dr. G. J. Bey-Bienko, the author of numerous valuable and very interesting papers on *Orthoptera, Dermaptera* and *Blattodea*.

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***65. Conophyma kittaryi** Tarbinsky, 1931 (Figs. 5A and B).

Dzhanbulak, 13. vi, 2 ♂♂; valley Ailjak, 14, vi, 2 ♀♀; settl. Norbek, 22. vi., 5 ♂♂, 1 ♀; Kara-bel, 28-6-1930, 1 ♂ (Umnov); Gurimar, 19-8-1930, 2 ♂♂, 3 ♀♀ (Maximov).

♀ (nova). Body large, robust, smooth.

Head somewhat elevated above the level of the pronotum, smooth. Eyes nearly round, slightly prominent sidewards; vertical diameter equal to horizontal diameter of the eye and nearly equal to interocular space. Face moderately sloping. Frontal ridge slightly depressed at the median ocellum, almost parallel-sided, obliterate at the clypeus; seen in profile flat, not prominent at the antennal bases; its margins thick. Fastigium of the vertex forming an angle of about 45°; vertex broad, not depressed at all, slightly convex; margins scarcely visible; median keel absent; maximum width about 2.25 times that of the frontal ridge between antennae. Temporal foveolae indistinct. Occiput slightly sloping. Antennae thin, not reaching the posterior margin of the pronotum, 20-22 jointed.

Pronotum smooth, feebly convex, punctured, with three weak transverse sulci, only the last sulcus intersecting median keel; median keel distinct; lateral keels slight, but distinct, interrupted and forming double set of keels on each side; first keels somewhat converging and reach only the first transverse sulcus; second keels begin near the first transverse sulcus and are divergent; metazona very short, punctured, its length about one-third that of the prozona; posterior margin straight, indistinctly excised in the middle. Lateral lobes of the pronotum punctured, feebly trapezoidal, somewhat narrowed at the lower margin, with three deep transverse sulci, interspaces between them rough; anterior margin feebly wavy, anterior lower angle obtuse, feebly rounded posterior margin almost straight, posterior lower angle obtuse, broadly-rounded; lower margin slightly obliquely-ascending, at the middle convex.

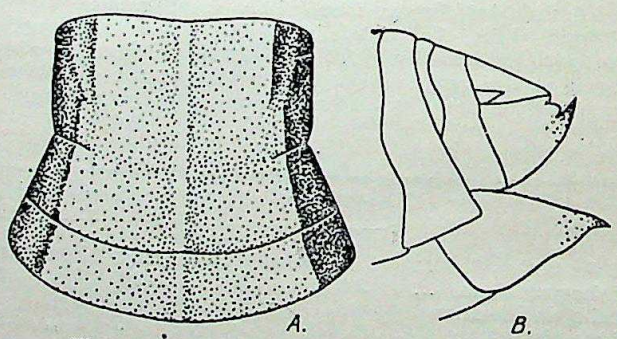

Fig. 5.—*Conophyma kittaryi* Tarbinsky; ♀.

A. Dorsal view of the pronotum.
B. Lateral view of the apex of abdomen; ×7.5.

Mesonotum and metanotum smooth, with a distinct median keel.

Sternum sparsely and finely punctured, its maximum width nearly equal to length; width of interspace between lobes of the mesosternum a little larger than its length.

Front and middle femora feebly swollen. Hind femur short; its length 3.3 times its maximum width. Hind tibia a little shorter than hind femur, with 8-9 spines on the outer and 9-10 spines on the inner side.

Abdomen, seen from above, with a distinct median keel. Subgenital plate nearly square. Valvae of the ovipositor with acute points; lower valvae with a small projection on the outer margin.

General coloration blackish-brown, with two dirty-yellow longitudinal stripes, angularly-inflexed on the pronotum and almost parallel-sided on the abdomen. Lateral lobes of the pronotum in the upper middle black, in the lower middle dirty-yellow. Antennae, head and legs—yellow-brownish. Sternum and abdomen,

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seen from below—dirty-yellow. Hind femur from within and below yellow, its upper margin with two darkish fasciae. Hind tibiae orange.

	♀♀	♂♂
Length of the body	21·5-23·5 mm	17·5-19·5 mm
,, pronotum ...	4·1- 4·5 ,,	3·3- 4·0 ,,
,, hind femora ...	10·0-10·2 ,,	8·5-10·0 ,,
,, hind tibiæ ...	8.5- 8·7 ,,	7·0- 8·5 ,,

***66. Calliptamus italicus italicus** (Linnaeus), 1758.
Mouth of the river Kunduz-Daria, 29-7-1931, 11 ♂♂, 5 ♀♀ (Maximov).

***67. Calliptamus siculus deserticola** (Vosseler), 1902.
Gurimar, 19-8-1930, 2 ♂♂, 7 ♀♀; Ak-Tepe, 27-7-1931, 8 ♂♂, 5 ♀♀ (Maximov).

***68. Kripa coelesyriensis** (Giglio-Tos), 1893.
Ak-Tepe, 27-7-1931, 3 ♂♂, 1 ♀ (Maximov).

69. Anacridium aegyptium (Linnaeus), 1764.
Recorded by Kirby (1889) from Badghis and Hari-Rud valley, under the name *Acridium aegyptium* (Linnaeus).

***70. Thisoecetrinus pterostichus** (Fischer de Waldheim), 1846.
Mouth of the river Kunduz-Daria, 29-7-1931, 2 ♂♂, 1 ♀ (Maximov).

71. Thisoecetrus littoralis asiaticus Uvarov, 1933.
Kazan, 11-8-1930, 1 ♂ (Maximov).
Recorded by Kirby (1889) from Afghanistan (between Khusan and Quetta), under the name *Euprepocnemis littoralis* (Rambur).

***72. Thisoecetrus adspersus** Redtenbacher, 1889.
Man-Guzar, 16-8-1930, 1 ♂, 4 ♀♀ (Maximov).

73. Kabulia afghana Ramme, 1928.
This species has been described by Ramme (1928) from Kabul.

***74. Gomphomastax morosus** sp. n. (Figs. 6A, B, C and D).
♀ (holotype). Body slender, rugulose.
Head rather large, elevated above the level of the pronotum, strongly rugulose. Eyes irregularly-oval, moderately prominent sidewards; the largest diameter of the eye a little less than the interocular space and 1.5 times the smallest diameter. Face very strongly sloping. Frontal ridge narrow, strongly depressed, almost parallel-sided, at vertex feebly triangularly dilated and reaching to the clypeus; seen in profile wavy, slightly prominent at the antennal bases; margins thin. Vertex convex, strongly rugulose, forming an acute angle with frontal ridge, margins scarcely visible; median keel distinct. Occiput feebly sloping, rugulose, with distinct median keel. Antennae thick and short, 12-jointed, a little longer than the length of the front femora, not reaching the posterior margin of the pronotum.
Pronotum rugulose; median keel slight, but distinct; posterior margin straight, at the median keel feebly triangularly-excised; lateral keels indistinct. Lateral lobes of the pronotum oblong, their length being larger than the height, rugulose; about the middle with a sharp transverse sulcus and distinct keel passed diagonally from the posterior upper angle to the anterior lower angle; anterior margin straight, anterior lower angle somewhat more than 90°, broadly-rounded; posterior margin slightly wavy, posterior lower angle nearly 90°, feebly rounded; lower margin slightly wavy and a little obliquely-ascending.
Mesonotum and metanotum slightly rugulose, with distinct median and lateral keels.
Sternum very finely and densely punctured, nearly square, with rounded angles and a border at the margins; anterior margin prominent; posterior margin triangularly-excised; interspace between lobes of the mesosternum about 3.5 times as long as its length,

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Arolia between claws of the tarsi small, reaching to the middle of claws.

Abdomen, seen from above, with an indistinct median keel. Valvae of the ovipositor with acute points; outer margin of the upper valvae with some irregular teeth; outer margin of the lower valvae with 4 large teeth. Posterior margin of the subgenital plate with 3 projections; the middle projection is longer, sharply-angular; two lateral projections obtusely rounded.

General coloration yellowish-brown with blackish design. Apical part of the antennae blackish.

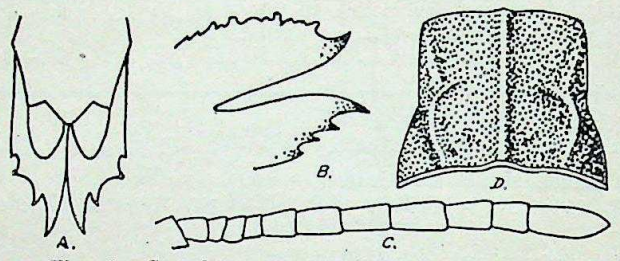

Fig. 6.—*Gomphomastax morosus sp. n.* type ♀.

A. Dorsal view of the subgenital plate; B. Lateral view of the ovipositor. C. Dorsal view of the antenna; D. Dorsal view of the pronotum of allotpye ♂; ×12.5.

♂ (allotype). Like the female, smaller. The largest diameter of the eye a little longer than the interocular space. Antennae thin, considerably longer than head and pronotum together, somewhat thickened at the apex. Hind femur very slender; their length nearly 6 times larger than the maximum width. Hind tibia considerably longer than hind femur, with 22 spines on the outer and 17 spines on the inner side. First joint of the hind tarsus with 4 spines on the outer and 5 spines on the inner margin. Subgenital plate, seen in profile, shortly triangular. Cerci rather long, straight, cylindrical, obtuse, with sparse hairs.

Coloration like the female.

	holotype ♀	allotype ♂
Length of the body ...	20·5 mm.	13·5 mm.
,, of the antennæ ..	4·5 ,,	...
,, of the pronotum ...	1·8 ,,	1·1 ,,
,, of the hind femora ...	...	7·8 ,,
,, of the hind tibiæ ...	...	9·0 ,,

Patria. North Afghanistan: pass *Irghailyk*, 14-6-1930, 1 ♀ (holotype), 1 ♂ (Umnov).

This new species is near to *Gomphomastax opacus* Krauss in Zubovsky (1898a), described by that author from Podgorny and Sasanovka (Kirghizstan), but differs from it by the following characters:

Gomphomastax morosus sp. n.	**Gomphomastax opacus** Krauss.
♀. Antennae thick, 12-jointed. Upper valvae of the ovipositor at apex of the outer margin with distinct large excision.	♀. Antennae thin, 23-25 jointed. Upper valvae of the ovipositor at apex of the outer margin without excision.

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THE KODAIKANAL BIRDS AND HOW TO NAME THEM.

BY

EDWARD G. NICHOLS.

Kodaikanal, in the Palni Hills, Madura District, is a good place to study birds. One's first impression is of a great abundance of bird-life in the trees, shrubbery, and open spaces about every house. After a short time, however, one notices that the same kinds of birds are seen again and again. The number of different species is actually not as large as in many places on the plains. This is an advantage for the beginner, since too many different birds seen at once would cause confusion. The reasons for the limited number of species are not far to seek. Firstly, Kodaikanal is too high for many birds. Some species live on the plains and never venture into the hills at all. Some, like the sparrows and crows, are brave enough to climb to about 5,000 ft., but not up to 7,000. Many other birds are found only in the forests between 2,000 and 5,000 ft. The species that prefer the hill-tops, and those that wander up so high, are comparatively few. Secondly, Kodikanal is too far south. Migrants from the north drop off one by one in the more northerly latitudes of India for the winter. Only a few reach 10° 14′ north latitude, where Kodaikanal is located. Thirdly, Kodaikanal has little water, and so there are few water-birds found there. Land-birds, too, would be more numerous if there were more woodland and more farms and gardens in place of the grassy downs which offer little shelter and in which the bird population is fairly scanty.

There are one or two drawbacks to the study of birds at Kodaikanal. One is the height of some of the trees. The blue-gums are so tall that one almost requires a telescope to see birds in them. Curiously, very few birds seem to like blue-gums, but there are many other big trees which tire the neck of the observer. Another hindrance is the density of the foliage in the *sholas* (jungles). This makes it hard to find a bird which moves about much, and one has to record many brief and imperfect observations. On the whole, however, it is a great place for birds, and those who find the difficulties of field-work too great can sit on the verandah and concentrate on a few species.

Purpose. When I first came to Kodaikanal, I longed for some book which would help me to identify the birds I saw. I have now, after seven seasons, named most of the common birds to my own satisfaction, and this paper is an attempt to provide for the beginner the help I myself needed. Of course, I wish it were illustrated, because a picture conveys more than many words. However, I have tried to give pictures, in broad strokes, with a few words. Most descriptions are so full as to confuse the reader. I have perhaps erred on the opposite side, giving only those few markings by which the species found at Kodaikanal can be

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distinguished from one another quickly and easily. For complete descriptions, you can go to the big books,—Baker and Inglis' *Birds of Southern India* (Government Press, Madras, 1930), or the eight-volume *Fauna of British India,—Birds.* But it is not necessary to know all the details of colouration when you meet a new bird. Having learned to recognize the species by a few distinctive marks or habits, you can fill in for yourself by observation the interesting and significant details. For some idea of the vast amount of fascinating information there is to be learned about each species, turn to Whistler's *Popular Handbook of Indian Birds.* Many of our species do not appear in Whistler's book, however.

Scope. All the species in this list have been recorded on the Palni Hills between 6,000 and 8,000 ft. elevation. I have limited myself to birds that are present during the season from April to June, since most people are in Kodaikanal then. There are only a few migrants and winter visitors in the list. I have omitted, for the most part, birds with which I am not personally acquainted. There may be some serious omissions because I have not been afield enough or in the right places. However, I am consoled by the knowledge that there is no such thing as a complete bird-list for any locality, since the day after a list is published a new bird may turn up. I have avoided as far as possible all reference to birds of the plains, since people who study birds in Kodaikanal may have little or no knowledge of the plains-birds of Madura District. The scientific ornithologist will ask for confirmation of some of my records by specimens. To this I reply that I do not use a gun, nor have I had personal access to any specimens collected at Kodaikanal. I have received some help, however, by a study of the following published lists, which are based for the most part on specimens collected:

'A List of Birds Collected and Observed on the Palani Hills', by Rev. S. B. Fairbank, D.D., in *Stray Feathers*, vol. v, 387 ff.

'A Few Additional Notes on Birds on the Pulney Hills', by Terry in *Stray Feathers,* vol. x, 467 ff.

'The Ornithology of Travancore and Cochin', by Sālim Ali in this *Journal*, beginning in vol. xxxvii. Mr. Sālim Ali collected in the High Range within 25 miles of Kodaikanal, and he is my authority for the names I have used, many of which are different from those found in *The Birds of Southern India*, thanks to the recent work on nomenclature done by Mr. Hugh Whistler.

TITS.

1. **Travancore Yellow-cheeked Tit.** *Machlolophus xanthogenys travancoreensis.*

Length: 6 in., the same as the Chat.

Field-marks: A wide black line below from the bill to the tail. Crested head. The head is black, with eyebrows and cheeks pale yellow.

Haunts: Trees, usually high up. They travel about in small groups, often in company with White-eyes. Fairly common.

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Song: A high-pitched clear whistle of several emphatic notes. Rather like a Grey-headed Flycatcher's call.

NUTHATCHES.

2. **Velvet-fronted Nuthatch.** *Sitta frontalis.*

Length: 5 in., smaller than the Chat.

Field-marks: Deep-blue above, rusty-white below. Bill red. A short, thick-set bird.

Haunts: It runs about on the bark of trees, often head down. From two to ten may be seen together, usually in thick woods. Fairly common.

Call: A rapid series of high-pitched 'chip's'.

LAUGHING THRUSHES.

3. **Wynaad Laughing Thrush.** *Garrulax delesserti.*

Length: 10 in., larger than the Myna.

Field-marks: Brown and slaty above. Cheeks and throat white. It lacks the conspicuous white eye-brow of the next species.

Haunts: Underbush. I have only one doubtful record of it, but the late F. Dawson thought he had seen it on its nest near Pillar Rocks. Rare.

Call: Said to be a very noisy bird.

4. **Palni Laughing Thrush.** *Trochalopteron jerdoni fairbanki.*

Length: 8.5 in., smaller than the Myna.

Field-marks: White eye-brow, with black lines above and below it. Olive-brown upper parts. Breast grey, abdomen rufous.

Haunts: Bushes and thick trees, in the settlement as well as in the wilder sholas. Discovered at Kodaikanal by Rev. S. B. Fairbank in 1867. Abundant.

Calls: Loud shrieks of delight, whistles of surprise, or snatches of laughter, which have a ventriloquial effect of being more distant than they really are. Often when one bird calls, all within hearing join, making the woods ring.

SCIMITAR BABBLERS.

5. **Travancore Scimitar Babbler.** *Pomatorhinus horsfieldii travancoriensis.*

Length: 8.5 in., smaller than the Myna.

Field-marks: Curved yellow bill like a scimitar. Plumage dark-brown, with pointed white breast-patch and eye-brow.

Haunts: Woods and sholas, usually in thick foliage. It sometimes clings to the bark of trees like an enlarged Nuthatch. Not often seen, but fairly common.

Call: Loud and wooden, resembling the tone of the Barbet, but lower and more deliberate. The notes often are: *do, do, do, do,* and then up to *fa, la.* As others have put it, one calls, 'Wot-ho-ho-ho', and before this is fairly out of his mouth comes the flute-like reply from his mate in the next bush, 'Yes, dear.'

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BULBULS.

6. **South Indian Black Bulbul.** *Microscelis psaroides ganeesa.*
Length: 10 in., larger than the Myna.
Field-marks: Blackish, with rather long, curved, bright-red bill. There is a short rough crest on the head. Grey below, especially toward the tail. The tail is longer than a Blackbird's.
Haunts: Constantly moving about in the tree-tops in larger sholas. Often one meets large, loose flocks. Fairly common.
Calls: Loud, harsh screams, uttered most of the time. They would be very unpopular if they came near houses much.

7. **Ceylon Red-vented Bulbul.** *Molpastes cafer.*
Length: 8 in., smaller than the Myna.
Field-marks: The whole head is black, with a rough crest. Most of the plumage is grey-brown with markings like scales.
Haunts: About gardens or on bushy slopes. I have never met it above 5,200 ft. elevation, but others have found it occasionally at Kodaikanal.
Call: A cheerful, bubbling whistle, rather lower in pitch and rougher than the call of the Red-whiskered.

8. **Southern Red-whiskered Bulbul.** *Otocompsa jocosa fuscicaudata.*
Length: 8 in., smaller than the Myna.
Field-marks: A sharp black crest, curving forward. Small red moustache. White below, with a brown collar-line.
Haunts: In bushy places, often in large flocks. Abundant.
Call: A musical series of whistled notes, high-pitched and tinkling.

9. **The Yellow-browed Bulbul.** *Iole icterica.*
Length: 8 in., smaller than the Myna.
Field-marks: A bright-yellow bird, when seen from below. Above, olive-green, with brown wings.
Haunts: The upper branches in thick woods, where it travels in loose companies up to 60 in number. I have not seen it in Kodaikanal, but Fairbank wrote that it came to 'the top'. Probably rare at this height.
Call: A clear, mellow, double whistle, given frequently.

SHORTWINGS.

10. **White-bellied Shortwing.** *Brachypteryx major albiventris.*
Length: 6.5 in., larger than the Chat.
Field-marks: A dark-blue bird with light-brown eyes, white rump, and rounded wings. Compare this description with that of the Nilgiri Flycatcher, which is very similar. Young birds are spotted like those of the flycatchers.
Haunts: Thick undergrowth in the sholas. Most in evidence at dusk, when they come out onto roads and paths. Discovered in Kodaikanal by Rev. S. B. Fairbank in 1867. Fairly common.

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Song: Beautiful and sprightly, long-continued and varied, uttered as the bird moves from twig to twig among the shadows. It is thrush-like in quality, but higher in pitch.

Calls: A loud chattering, and at times a faint high whistle.

CHATS.

11. **Southern Indian Stone Chat.** *Saxicola caprata atrata.*

Length: 6 in., smaller than the House Sparrow.

Field-marks: A stubby black bird with three white patches, on shoulders and rump. The female is brown with a pink rump.

Haunts: It perches on a bush-top in an open place, making short dashes to the ground or up into the air for insects. Abundant.

Call: Gives it its name. The song is short but rather sweet.

ROBINS.

12. **Ceylon Magpie-Robin.** *Copsychus saularis ceylonensis.*

Length: 9 in., smaller than the Myna.

Field-marks: A long-tailed black bird, with white belly and white in the wings and tail, but none on the rump.

Haunts: Orchards up to the level of Kodaikanal. Regularly found in the valley below the United Church.

Song: Clear, shrill, and varied, divided into short phrases. Heard most early in the morning.

THRUSHES.

13. **Travancore Blackbird.** *Turdus simillimus bourdilloni.*

Length: 10 in., larger than the Myna.

Field-marks: All blackish, with orange bill and legs. The female is dark-brown and grey. Many birds have yellow legs, and seem closer to *T. s. simillimus*, the Nilgiri Blackbird. Whistler thinks our Palni Hills birds are intermediate, but closer to Bourdillon's.

Haunts: In trees. It does not come out on open lawns, as much as its relatives, the English Blackbird and American Robin. Common.

Song: Loud, clear, and varied. Sung with a few pauses all day long.

14. **Nilgiri Thrush.** *Oreocincla dauma neilghiriensis.*

Length: 9.5 in., the same as the Myna.

Field-marks: Above, brown, somewhat spotted. The wing is barred with black. Below, white with brown spots.

Haunts: Forests, where it searches for insects among fallen leaves. The only record I know for Kodaikanal is by Terry, who shot one on its nest on June 7th.

Song: Said to be not so continuous as that of the Blackbird, but with longer intervals between brief phrases.

15. **Malabar Whistling Thrush.** *Myophonus horsfieldii.*

Length: 12 in., as large as the Dove.

Field-marks: Black, with patches of bright blue on wings and forehead.

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Haunts: Along a water-course in a wild and wooded ravine. Fairly common.

Song: Heard at sunset and early in the morning. The smoothness and clearness of its tones, and the length and variety of the song, are remarkable. It has forgotten its tune, but it whistles on. Many of the tones are lower than the human whistler can reach, so the name 'Whistling Schoolboy' is not entirely appropriate.

FLYCATCHERS.

16. **Tickell's Blue Flycatcher.** *Muscicapula tickelliae.*

Length: 6 in., the same as the Chat.

Field-marks: Dark blue, but with the breast reddish.

Haunts: Large shady trees without undergrowth. Fairbank observed it frequently from top to bottom of the hills, but I have met it only in the lower hills. Rare.

Song: Said to be 'a musical little trill', or 'a little whistling chirrup'.

17. **Nilgiri Blue Flycatcher.** *Eumyias albicaudata.*

Length: 6 in., the same as the Chat.

Field-marks: Dark-blue nearly all over. The outer tail feathers are white at the base. Vent grey. Legs black. It should be carefully compared with the Shortwing. The female is dull brown and blue. Young speckled birds with only a few spots of blue are often seen.

Haunts: In trees, near houses or in remote sholas. Common.

Song: A mild, rather sweet song of 6 or 8 notes, often with a glide in each note that gives it a somewhat mournful effect. The bird is lethargic, and sings for a long time from one open perch all through the day.

18. **Black and Orange Flycatcher.** *Ochromela nigrorufa.*

Length: 5 in., smaller than the Chat.

Field-marks: Head, neck, and wings black, the rest burnt-orange.

Haunts: In the thickest bushes of the darkest sholas. Fairly common.

Song: Rather sweet, but hoarser than that of the Grey-headed. It has usually only three notes to a phrase, and is a little lacking in animation.

Call: A series of 4 or 5 chattering notes.

19. **Grey-headed Flycatcher.** *Culicicapa ceylonensis.*

Length: 5 in., smaller than the Chat.

Field-marks: A dark-blue head (in spite of the name). The rest of the bird is yellow and olive.

Haunts: Found in groups or pairs in the sholas. They are seldom still, but constantly dashing about, catching insects on the wing. Common.

Song: A thin and high-pitched trill, somewhat metallic in quality. It has a call of four whistled notes, sweet and clear. There is also a variety of explosive alarm-notes.

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SHRIKES.

20. **Southern Rufous-backed Shrike.** *Lanius schach caniceps.*
Length: 9 in., smaller than the Myna.
Field-marks: A black mask over the eyes. Ashy-grey above and white below. Rump, sides, and lower back are rufous.
Haunts: It chooses an open and conspicuous perch. Common.
Call: Its nasal grating note is longer than a similar note of the Myna's. Its song, not a bad attempt, is less commonly heard.

21. **Black-backed Pied Shrike.** *Hemipus picatus.*
Length: 5.5 in., smaller than the Chat.
Field-marks: Head and upper parts mainly black, beneath white.
Haunts: An active bird of the tree-tops, sometimes in company with White-eyes and Tits. Uncommon.
Song: Weak and high-pitched, but clear and varied. One form of it see-saws back and forth between two notes.

MINIVETS.

22. **Orange Minivet.** *Pericrocotus flammeus.*
Length: 8 in., smaller than the Myna.
Field-marks: Head and upper back black, the rest bright red-orange. The female is yellow, grey, and black.
Haunts: Always seen in small flocks in the tree-tops. Fairly common.
Call: Some high, clear whistles draw one's attention to the arrival of a flock in a nearby tree. The song is a shrill, pleasant warble, not often heard.

SWALLOW SHRIKES.

23. **Ashy Swallow-Shrike.** *Artamus fuscus.*
Length: 7 in., larger than the Chat.
Field-marks: A short, thick-set bird, with short, pointed wings. Bill thick and pale-blue. Plumage dark bluish-ashy.
Haunts: They may be seen, often in pairs, sitting motionless on a high branch of a blue-gum tree, or soaring slowly in mid-air. Uncommon.
Call: A soft nasal 'yank', which is easily remembered when once heard.

DRONGOS.

24. **Southern Bronzed Drongo.** *Chaptia aenea malayensis.*
Length: 9 in., smaller than the Myna.
Field-marks: Glossy blue-black, with a long forked tail.
Haunts: Open perches. I have seen a Drongo in Kodaikanal only once, at Pambar House garden. It was most likely this species, which is found in the lower hills. Rare.
Song: Much sweeter than the plains bird's.

WARBLERS.

25. **Blyth's Reed Warbler.** *Acrocephalus dumetorum.*
Length: 6 in., the same as the Chat.

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Field-marks: Tail long and graduated. Olive-brown above. A pale streak from top of bill to eye. Throat whitish, belly pale buff.

Haunts: Dense undergrowth. In Travancore, this is a winter visitor, leaving in mid-April. But Terry shot one at Putthur (6,000 ft.) on June 26th, and saw a pair at Kukkal. So perhaps it breeds in these hills. Rare.

Call: A sudden 'chick' or 'chuck' or 'chur-r-r', at frequent intervals.

Song: A slight warble, according to Wait.

26. **Red-headed Fantail Warbler.** *Cisticola exilis erythrocephala.*

Length: 4 in., smaller than the Chat.

Field-marks: The top of the head is chestnut. The back has black streaks. The under-parts are rusty.

Haunts: Open grass-lands. I have found it common only in a few localities.

Call: A nasal 'peeeenk', followed by a clear whistled 'toowhee'. (Beavan's Wren-Warbler, *Franklinia rufescens*, and the Rufous-fronted Wren Warbler, *Franklinia buchanani*, are said by the authorities not to be found as far south as Kodaikanal. I have records that seem nearer to these than to any other species. Perhaps further collecting on the Palni Hills will show an extension of the known range of at least one of the Franklinias.)

27. **Broad-tailed Grass Warbler.** *Schoenicola platyura.*

Length: 7 in., larger than the Chat.

Field-marks: The under-parts are bright-rusty, except for a white band down the centre. Above, red-brown. The eye-brow is grey and inconspicuous.

Haunts: Bracken slopes, singing from a bush-top. Uncommon.

Song: A shrill and sweet trill, ending with a few warbling notes and 'chack's'. It is the best song of any of our warblers'.

28. **Thick-billed Warbler.** *Phragamaticola aëdon.*

Length: 7.5 in., larger than the Chat.

Field-marks: Above, light-brown, with a tinge of yellowish. No white eye-brow. Tail graduated.

Haunts: Tall grass and weeds. A winter visitor only, but I have records until May 2nd. Rare.

Call: A loud, harsh 'chuck' and 'chur-r', quickly repeated.

29. **Sykes' Tree Warbler.** *Hippolais rama.*

Length: 5.5 in., smaller than the Chat.

Field-marks: Tail slightly rounded. Olive-brown above, with a faint pale eyebrow. Below, pale buff, with the throat and centre of abdomen nearly white.

Haunts: Thick bushes. A winter visitor staying into April. Rare.

Call: A low wren-like chatter.

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30. **Tickell's Willow Warbler.** *Phylloscopus affinis.*

Length: 4.5 in., smaller than the Chat.

Field-marks: Deep yellow below, dull olive above. No wing-bars. Yellow eye-brow.

Haunts: Trees, moving about constantly among the leaves. A winter visitor staying through April. Fairly common.

Song: A brief, twittering warble.

31. **Green Willow Warbler.** *Phylloscopus nitidus nitidus.*

Length: 5 in., smaller than the Chat.

Field-marks: Green above, yellow below. Two wing-bars. Yellow eye-brow.

Haunts: Trees. A winter visitor, noted as late as mid-May. Rare.

Call: A little 'chirrup' or 'chi-wee'.

32. **Greenish Willow Warbler.** *Phylloscopus nitidus viridanus.*

Length: 5 in., smaller than the Chat.

Field-marks: One faint wing-bar. Yellow eyebrow. Olive-brown above, under-parts yellowish grey.

Haunts: A restless bird, found in heavy foliage. It is a winter visitor only, and disappears about the middle of May. Fairly common.

Song: A brief, pleasant warble of four or five notes, given very frequently.

33. **Large-billed Willow Warbler.** *Phylloscopus magnirostris.*

Length: 5.5 in., smaller than the Chat.

Field-marks: Two wing-bars. Yellow eye-brow. Below, pale yellow, with much grey on the breast.

Haunts: A winter visitor, in trees, staying until late in April. Said to be common in the Travancore hills. I have only a few doubtful records. Rare.

Song: A whistle of 2 or 3 or 4 syllables (authorities differ), almost robin-like in tone.

34. **Western Dull-green Willow Warbler.** *Phylloscopus trochiloides ludlowi.*

Length: 5 in., smaller than the Chat.

Field-marks: The eye-brow is smaller and less conspicuous than in the preceding species.

Haunts: Some of our transient warblers in April probably belong to this species. In trees. Rare?

Call: A sparrow-like chirp, repeated several times in succession.

35. **Large-crowned Willow Warbler.** *Phylloscopus occipitalis.*

Length: 5 in., smaller than the Chat.

Field-marks: Resembles the other willow-warblers, but there is a distinct pale line from the bill backward over the top of the head.

Haunts: Trees. A winter visitor only. My only record is on April 21.

Call: A loud, sharp 'tit-weet'.

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36. **Ashy Wren-Warbler.** *Prinia socialis.*

Length: 5.5 in., smaller than the Chat.

Field-marks: Smooth bluish-grey above. Black line through eye. Below, pink. The most brightly-coloured of our warblers.

Haunts: Bracken slopes, where it sings from a bush-top or in a short flight. Common.

Song: A shrill, emphatic, double note, repeated 5 or 6 times together. In rhythm, this song is similar to that of the Tailor-bird but its tone is less musical.

Calls: A cat-like snarl, and a nasal scolding.

37. **South Indian Wren-Warbler.** *Prinia inornata franklinii.*

Length: 6 in., the same as the Chat.

Field-marks: Dull brown above, the feathers slightly darker at their centres. Eye-brow white. Tail white-tipped.

Haunts: Bracken slopes, especially on the higher hills. Common.

Song: An insect-like 'tlik, tlik—', more wheezy than the preceding.

Call: A little 'kink, kink,—'.

MYNAS.

38. **Southern Jungle Myna.** *Aethiopsar griseus mahrattensis.*

Length: 9.5 in., larger than the Bulbul.

Field-marks: Some erect feathers on the forehead. It lacks the bare yellow skin around the eye of the plains bird, and is more slaty than brown.

Haunts: About houses. Its name 'Jungle' is a mistake, as far as we can see in Kodaikanal. Abundant.

Calls: Varied and rough, less musical than those of the Common Myna.

MUNIAS.

39. **Black-headed Munia.** *Munia malacca.*

Length: 5 in., smaller than the Chat.

Field-marks: Black head, chestnut-red wings and back, and white belly. Its thick, seed-crunching bill is pale blue in colour.

Haunts: Small flocks in weeds on open hillsides or in gardens. Uncommon.

Call: A very sweet chattering.

40. **White-throated Munia.** *Uroloncha malabarica.*

Length: 5 in., smaller than the Chat.

Field-marks: Plumage light-brown above, white below and on face. The tail is blackish and wedge-shaped. Bill dull bluish.

Haunts: Bushy hillsides. Rare.

Call: A feeble 'chee, chee,——'.

41. **Indian Spotted Munia.** *Uroloncha punctulata lineoventer.*

Length: 5 in., smaller than the Chat.

Field-marks: Dark red-brown head, golden-brown back. Below, blackish, finely dotted with white.

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Haunts: Found in small flocks in weeds, chiefly at lower elevations. Rare.

Call: A petulant 'kitty-kitty-kitty', according to Whistler.

42. **Indian Red Munia.** *Amandava amandava.*

Length: 4 in., smaller than the Chat.

Field-marks: Dark red, with some small white spots. The female is a brown bird with only a little red on the back.

Haunts: In flocks in bushes on open hillsides. Uncommon.

Calls: A high-pitched musical twittering.

FINCHES.

43. **Common Indian Rose Finch.** *Carpodacus erythrinus roseatus.*

Length: 6 in., the same as the Chat.

Field-marks: Brown, tinged with rosy, especially on the head. Conical bill.

Haunts: I have seen it only along the edges of sholas. A winter visitor, until mid-April. Rare.

Song: Said to be rather pleasant.

SWALLOWS.

44. **Nilgiri House Swallow.** *Hirundo javanica domicola.*

Length: 5 in., smaller than the Chat.

Field-marks: Glossy blue-black above. Tail forked, spotted near the end with white.

Haunts: Breeds in a few houses, especially near Coaker's Walk. It swoops low through the air, bringing its wings back close to its body with each stroke. Contrast the Swift's method of flying. Fairly common.

Calls: A musical twittering, and a variety of shrill squeals and whistles.

WAGTAILS.

45. **Large Pied Wagtail.** *Motacilla maderaspatensis.*

Length: 9 in., smaller than the Myna.

Field-marks: Head, throat, and back black. Eye-brow and lower parts white. Long tail.

Haunts: Around the lake and along water-courses. Often finds its food on lawns. A convenient housetop is a favourite perch. Fairly common.

Song: High-pitched, long, and clear,—one of the finest at Kodaikanal.

46. **Eastern Grey Wagtail.** *Motacilla cinerea caspica.*

Length: 7·5 in., larger than the Chat.

Field-marks: Grey above, yellow and white below. A constantly wagging tail.

Haunts: This is a winter visitor, but until mid-May is a conspicuous bird, likely to be met anywhere in the settlement, on the ground. Common.

Call: A high-pitched, strong 'seep'.

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PIPITS.

47. **Indian Tree Pipit.** *Anthus hodgsoni.*

Length: 7 in., larger than the Chat.

Field-marks: Streaky olive-brown above. Below, creamy and white, with brown spots all the way from the neck to the vent.

Haunts: A winter visitor, leaving in April or early May. Found on the ground in shady places, where it can fly into a tree for safety. Fairly common.

Call: A faint, plaintive note.

48. **The Nilgiri Pipit.** *Anthus nilghiriensis.*

Length: 7 in., larger than the Chat.

Field-marks: Streaked with black and pale olive above. Eye-brow rufous. Lower parts tawny, the breast and sides being streaked with black.

Haunts: Open grassy hills. I think I have seen it a few times. Fairbank called it common, and Terry found it more common than the Malay Pipit.

Song: A chipping song given while fluttering in the air, probably belongs to this species.

49. **Rufous Rock Pipit.** *Anthus similis.*

Length: 8 in., smaller than the Myna.

Field-marks: A narrow black moustache. Only the breast is spotted with brown. Above, streaky dark-brown. Below, creamy, and eyebrow of the same colour.

Haunts: I have found it regularly on the swampy meadow near the south-west corner of the lake, and occasionally elsewhere. Fairly common.

Song: A feeble, high whistle, given during a circular dipping flight, followed by a dive to the ground. Or, a few high-pitched 'chip's'.

50. **The Malay Pipit.** *Anthus rufulus malayensis.*

Length: 6.5 in., larger than the Chat.

Field-marks: Streaked above with pale brown, dark brown, and blackish. The eye-brow and lower parts are pale creamy. The sides and breast are streaked with dark brown.

Haunts: In open grassy land. I have found it at the south-west corner of the lake. Fairly common.

Song: Five to ten 'chink's', uttered while flying up a short distance.

LARKS.

51. **Small Nilgiri Sky Lark.** *Alauda gulgula australis.*

Length: 6.5 in., larger than the Chat.

Field-marks: Streaked with dark brown and rufous above. Eye-brow and under-parts tinged with rufous. The breast is streaked with brown. Distinguished from the Pipits by its more crouching position, and its habit of squatting instead of running away when one approaches.

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Haunts: On the downs outside the settlement. Abundant.
Song: Long, sweet, and inspiring, given while the bird soars higher than the eye can follow.
Call: A liquid 'chirrup'.

52. **Malabar Crested Lark.** *Galerida malabarica.*
Length: 7 in., larger than the Chat.
Field-marks: A crest on the head; otherwise a streaky brown bird like the Sky Lark.
Haunts: Grassy hill-tops just beyond the houses. Fairly common.
Song: Said to resemble the Sky Lark's. Often, a lark song is a mere chattering or chipping, and lasts not more than a quarter of a minute. Perhaps such songs are from this species.
Call: A rather sweet 'tee-ur', according to Whistler.

WHITE-EYES.

53. **The Nilgiri White-eye.** *Zosterops palpebrosa nilgiriensis.*
Length: 4 in., smaller than the Chat.
Field-marks: Yellow-green above. Breast yellow, belly white. A white eye-ring.
Haunts: Always found in trees or bushes, busily moving from branch to branch in loose companies. Abundant.
Song: Their mild querulous notes are heard all the time. They remind me of the call of a baby chick which is somewhat sleepy. The song is a brief, weak trill.

SUNBIRDS.

54. **The Small Sunbird.** *Cinnyris minima.*
Length: 3.5 in., our smallest bird (with the Flowerpecker).
Field-marks: Curved bill. Head and neck dull green. Wings dark brown. Underparts entirely deep yellow. There are other plumages, and in them all the red back is a distinguishing mark, but this is not easy to see.
Haunts: About flowers. Fairly common.
Song: A loud, ringing trill.

SPIDER-HUNTERS.

55. **Little Spider-hunter.** *Arachnothera longirostra.*
Length: 6 in., one-fourth of which is bill. Smaller than the Chat.
Field-marks: An extra-long bill. Throat white, belly yellow. Above, dull brown, grey, and olive.
Haunts: Around flowering trees. Rare.

FLOWERPECKERS.

56. **Nilgiri Flowerpecker.** *Dicaeum concolor.*
Length: 3.5 in., shares with the Small Sunbird the distinction of being our smallest bird.
Field-marks: Very dull coloured. The upper parts are green and brown, the lower parts whitish. Face white,

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Haunts: A restless bird, seldom allowing a good view. Always well up in trees, favouring those that have parasitic growths on them. Abundant.

Call: A sharp 'check' makes identification easy.

Song: A high-pitched trill, weak and wiry.

WOODPECKERS.

57. **Little Scaly-bellied Green Woodpecker.** *Picus xanthopygaeus.*

Length: 11 in., smaller than the Dove.

Field-marks: The back is green and much-spotted. The male has a large red crest, the female a black one.

Haunts: On tree-trunks and large branches. Uncommon.

Call: Its drumming is as rapid as a steam-hammer, and must give the bird the same satisfaction that most birds get from singing. Its call is a single, mild, falsetto note, not often heard.

58. **Malherbe's Golden-backed Woodpecker.** *Chrysocolaptes guttacristatus chersonesus.*

Length: 11 in., smaller than the Dove.

Field-marks: The back and wings are golden-olive, lower back crimson. The male is red-crested, the female content with black. The black and white lines on the side of the head are conspicuous.

Haunts: On tree-trunks. Uncommon.

Call: A harsh scream of several syllables.

BARBETS.

59. **Small Green Barbet.** *Thereiceryx viridis.*

Length: 9.5 in., the same as the Myna.

Field-marks: All green, except for a streaked brown head and white chin. The bill is heavy and flesh-coloured.

Haunts: In thick trees, where its bright colour matches the leaves. Abundant.

Song: Wooden in tone, loud, and frequently uttered. One form is a long trill, followed by a two-syllabled 'hook-krrr', often repeated. When one bird sings, others join in the chorus. The Hoopoe's note is softer in tone, the Scimitar's deeper.

CUCKOOS.

60. **Southern Crow-Pheasant.** *Centropus sinensis parroti.*

Length: 19 in., larger than the Dove.

Field-marks: All black, except for the wings, which are red-chestnut. The eyes are red.

Haunts: This dignified, overgrown cuckoo is found in thick bushes and on the ground, often near houses. I have seen it only once as high as Kodaikanal. Rare.

Call: A hoot of very deep tone. It is loud enough to be heard clearly a mile or more away. Except that it does not inhale, it reminds one of the call of the Langur Monkey.

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KINGFISHERS.

61. **Common Ceylon Kingfisher.** *Alcedo atthis taprobana.*
Length: 6 in., the same as the Chat.
Field-marks: Bright-blue back. The head is dark, with a streak of white behind the eye. Below, chestnut. **The Three-toed Kingfisher** with its orange head and rump, may also occur here.
Haunts: Lakes and streams. Uncommon.
Call: A sharp squeak.

62. **Ceylon White-breasted Kingfisher.** *Halcyon smyrnensis fusca.*
Length: 10.5 in., larger than the Myna.
Field-marks: Large red bill, with an oversized head. White breast, sharply contrasted with dark brown below and blue above.
Haunts: Usually they nest in the sand-bank near the ball-field. Uncommon.
Call: A loud, defiant, rattling laugh.

HOOPOES.

63. **Ceylon Hoopoe.** *Upupa epops ceylonensis.*
Length: 11 in., smaller than the Dove.
Field-marks: A remarkable rufous and black crest, which it folds and spreads frequently, like a fan. Mostly tan-coloured, with black and white wings. A long, curved bill.
Haunts: Never far from houses, in any opening of which it nests. Feeds mostly on the ground. Common.
Call: A soft, wooden 'hoop, hoop', softer than a Barbet's notes. Sometimes, three 'hoop's' are given together.

SWIFTS.

64. **White-rumped Spinetail.** *Indicapus sylvaticus.*
Length: 4.5 in., smaller than the Chat.
Field-marks: Blackish, with both rump and belly white.
Haunts: In the air all the time, usually near forests at lower elevations. I have seen it only once near Pillar Rocks.
Call: A rapidly-repeated 'swicky-sweezy'.

65. **Indian Alpine Swift.** *Micropus melba bakeri.*
Length: 8 in., smaller than the Myna.
Field-marks: The lower parts are white, except for a brown band across the breast. The upper plumage is smooth brown. Tail forked.
Haunts: Seen singly, high in air, flying very swiftly and soaring a good deal. The manner of flight of any swift distinguishes it at once from a swallow. The swift's wings are not brought back parallel with the body, but are held well out from the body like the flukes of an anchor. Uncommon.
Call: Loud, shrill, and tremulous.

66. **Nepal Indian House Swift.** *Micropus affinis nipalensis.*
Length: 5 in., smaller than the Chat.
Field-marks: A blackish bird with a white rump.

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Haunts: In large flocks high in the air, occasionally at Kodaikanal, more common at other places in the hills.

Call: A musical twittering, kept up all the time.

67. **Indian Edible-nest Swiftlet.** *Collocalia fuciphaga unicolor.*

Length: 5 in., smaller than the Chat.

Field-marks: Dull brown above, with darker wings. Grey below. The Swiftlet is a slow-flying bird, and flutters much more than the Swallows and other Swifts.

Haunts: Seen flying over the lake or open places anywhere. Said to nest in the 'chimney' at Pillar Rocks. Abundant.

Call: A shrill twittering, less musical than that of the House Swift. Often they are silent.

68. **Indian Crested Swift.** *Hemiprocne coronata.*

Length: 9 in., smaller than the Myna.

Field-marks: Blue-grey above, grey and white below. The blackish tail is very deeply forked.

Haunts: Flying. Rare.

Call: Resembles a parrot's scream.

NIGHTJARS.

69. **Indian Jungle Nightjar.** *Caprimulgus indicus.*

Length: 11 in., smaller than the Dove.

Field-marks: The tail has a broken band of white across near the end. The general effect is grey-brown, much mottled.

Haunts: Near woods, at night. Terry found it common at some places in the hills. Rare at Kodaikanal.

Call: *Do-sol* (lower), repeated over and over. Also, a low 'chuck'.

OWLS.

70. **Bengal Brown Fish Owl.** *Ketupa zeylonensis leschenaulti.*

Length: 24 in., twice as large as the Dove.

Field-marks: Ear-tufts ('horns') present. The facial disc is not clear.

Haunts: Sholas, at night. Rare.

Call: 'Gloom-oh-gloom', in a solemn bass voice.

VULTURES.

71. **Indian Long-billed Vulture.** *Gyps indicus.*

Length: 38 in., our largest bird.

Field-marks: Brown and whitish, rather patchy in appearance. A young White Vulture will answer to this description also, but is readily told by its size.

Haunts: Usually below the town. Rare.

72. **Indian White-backed Vulture.** *Pseudogyps bengalensis.*

Length: 35 in., three times as large as the Dove.

Field-marks: A blackish bird, with white patches on the lower back, sides, and under-wings. Like the other vultures, its head appears too small for its heavy body and broad wings.

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Haunts: Often several soaring about below the bazaar. Fairly common.

73. **Smaller White Scavenger Vulture.** *Neophron percnopterus ginginianus.*

Length: 24 in., twice as large as the Dove.

Field-marks: Yellowish-white, with some black in the wings.

Haunts: Chiefly below the bazaar, looking for carrion and garbage. Fairly common.

FALCONS.

74. **Indian Kestrel.** *Falco tinnunculus objurgatus.*

Length: 13 in., larger than the Dove.

Field-marks: A slender, long-tailed hawk, mainly red and blue in colour.

Haunts: Open hillsides. It often stands in one spot in the air, either by beating its wings rapidly or by facing the wind almost motionless. Fairly common.

Call: A shrill laughing scream.

EAGLES.

75. **Bonelli's Eagle.** *Hieraëtus fasciatus.*

Length: 27 in., over twice as large as the Dove.

Field-marks: Below, white with black streaks. Above, dark brown with white splotches. Tail cross-barred below.

Haunts: This dignified bird may be met along the borders of woods, in or out of the settlement. Uncommon.

Call: Shrill and creaking.

76. **Indian Black Eagle.** *Ictinaëtus malayensis perniger.*

Length: 27 in., over twice as large as the Dove.

Field-marks: All black, except for yellow beak and legs.

Haunts: Not far from forests. I have seen a pair in the open from Coaker's Walk.

Call: A shrill cry.

KITES.

77. **The Brahminy Kite.** *Haliastur indus.*

Length: 20 in., larger than the Dove.

Field-marks: Head and neck white, the rest chestnut-brown. The immature bird is splotchy, and its best mark is a prominent white band across the under side of the wing.

Haunts: May be seen flying anywhere about the settlement, not far from water. Uncommon.

Call: A squealing note.

78. **The Common Kite.** *Milvus migrans govinda.*

Length: 21 in., larger than the Dove.

Field-marks: Tail slightly forked. Streaky dark-brown plumage.

Haunts: Anywhere around the town, in the air, looking for scraps to eat. Common.

Call: A shrill, quavering scream.

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BUZZARDS.

79. **Black-winged Kite.** *Elanus caeruleus vociferus.*
Length: 13 in., larger than the Dove.
Field-marks: Above, grey and black. The forehead, lower parts, and most of the tail, are white.
Haunts: They fly low over grassy hilltops, as graceful as terns over the sea. Rare.
Call: Said to be a thin, high-pitched squeal.

HAWKS.

80. **Indian Shikra.** *Astur badius dussumieri.*
Length: 13 in., larger than the Dove.
Field-marks: A small, slender, ashy-grey hawk. The wings are short and rounded, the tail long.
Haunts: Dashes through light forest. I have only two Kodaiknal records.
Call: A loud, shrill cry, 'titu, titu——'.

PIGEONS.

81. **Jerdon's Imperial Pigeon.** *Ducula badia cuprea.*
Length: 17 in., larger than the Dove.
Field-marks: Grey, bluish, and brown. Throat white.
Haunts: They sit quietly in heavy trees in sholas. Rare.
Call: A loud, booming 'who, whoo'.

82. **Indian Blue Rock Pigeon.** *Columba livia intermedia.*
Length: 12 in., the same as the Dove.
Field-marks: Slaty-blue, with black bars in wings and tail. The tail is short and squarish. This is the ancestor of the domestic pigeon.
Haunts: In the vicinity of rocky cliffs where they nest. Uncommon.
Call: Resembles that of the domestic bird.

83. **Nilgiri Wood Pigeon.** *Columba elphinstonii.*
Length: 16 in., larger than the Dove.
Field-marks: Brown wings. On the side of the neck, a black patch with small white spots in it. Otherwise greenish-grey.
Haunts: They sit quietly in dense trees. Uncommon.
Call: 'Coo's' of very low tone, from four to eight in number. Softer than the Crow-Pheasant's call, they are more owl-like in quality.

DOVES.

84. **Indian Spotted Dove.** *Streptopelia chinensis suratensis.*
Length: 12 in., larger than the Hoopoe.
Field-marks: Head is small in proportion to the body. The tail is longer than in the pigeons. The wings and back are pale brown with lighter spots. Otherwise, mostly ashy-grey.
Haunts: In trees. Common.
Call: A soft, wooden 'cuck*oo*, cooo, cooo, cooo'. The tone is similar to the Hoopoe's note, but the rhythm is distinctive.

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JUNGLE FOWL.

85. **Grey Jungle Fowl.** *Gallus sonneratii.*
Length: 30 in., half of which is tail. A large bird.
Field-marks: Black and brown with white spots.
Haunts: Larger jungles, mostly below Kodaikanal. Uncommon.
Call: A fowl-like crow, 'kuk-kaa kurra kuk'.

SPUR-FOWL.

86. **Travancore Red Spur-Fowl.** *Galloperdix spadicea stewarti.*
Length: 15 in., larger than the Dove.
Field-marks: A slender, pheasant-like fowl. Dark brown and chestnut, with a red bill.
Haunts: Larger jungles and pine plantations. Fairly common.
Call: A chuckling or cackling cry, usually of only two syllables.

QUAIL.

87. **Malabar Jungle Bush-Quail.** *Perdicula asiatica vidali.*
Length: 6.5 in., larger than the Chat.
Field-marks: Brown, marked with chestnut and black above. Below, cross-bars of black and white.
Haunts: On the ground, in tall grass and bushes on the downs. Rare.
Call: A whistled 'tiri-tiri-tiri'.

88. **Painted Bush-Quail.** *Cryptoplectron erythrorhynchum.*
Length: 7 in., larger than the Chat.
Field-marks: Brown, with black and buff streaks. A white throat bordered with black.
Haunts: Little groups of them run along the ground in thick grass or underbrush remote from houses. They give one the briefest sort of view when they fly off. Uncommon.
Call: A whistled 'kirikee', repeated several times.

WOODCOCK.

89. **The Woodcock.** *Scolopax rusticola.*
Length: 13 in., larger than the Dove.
Field-marks: Long bill. Stripes across the head, not lengthwise. Beautifully mottled brown, black, and white.
Haunts: A winter visitor only, staying into May. Found in woods near water. Rare.
Call: A nasal 'beep' when flying about at dusk.

SNIPE.

90. **Fantail Snipe.** *Capella gallinago.*
Length: 10.5 in., larger than the Myna.
Field-marks: A thick-set bird with a long bill. Three yellowish lines run lengthwise over the top of the head. The upper plumage is streaked black, white, and brown. Below, mostly white.
Haunts: Swampy places near sholas. Flies usually at dusk. It stays as a migrant until early May. Uncommon.
Call: A nasal 'scap'.

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SOME BIRDS OF LYALLPUR AND THEIR FOOD.

BY

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INTRODUCTION.

A number of contributions on the bird fauna of North West India have appeared from time to time in the *Journal of the Bombay Natural History Society*. Rattray (1905) and Magrath (1909) gave an account of the birds of Murree and the Gullis. Curree (1915) studied the birds of Lahore and its vicinity. Hugh Whistler (1915, 1917, 1920, 1927, 1928) investigated the avian fauna of the Dalhousie hills, Gujranwala, Ambala, Ludhiana, Fagoo (near Simla), Simla and Kulu. Jones (1920, 1921, 1927) worked on the birds of Simla, Campbellpore-Attock and Ambala. Hingston (1921) devoted his attention to the birds of Delhi. Briggs and Osmaston (1928) interested themselves in the bird fauna of Peshawar.

The recently-opened-up canal colonies have so far remained unrepresented and this opportunity is taken to place on record information regarding the birds of Lyallpur.

As friends and foes of the farmer the birds are second in importance only to the insects, and, therefore, for an agricultural country the study of the bird fauna is of paramount importance. A study of the food habits of the birds commonly found in gardens and fields at Lyallpur was taken in hand in 1926, and an area within ten miles radius of the Punjab Agricultural College, Lyallpur, has been surveyed.

It is generally recognized that the capacity for damage or good depends, largely, on the number of individuals. Every grain- or fruit-feeding species is a potential foe and every insect feeder a potential friend, but as long as the number of individuals is small the value of a particular species is insignificant. Thus it is not always possible to assign a definite status to a species.

The study of the bird fauna of Lyallpur is of added interest when one recollects, that not long ago this tract was almost barren and a most inhospitable spot. Here nothing but *Prosopis spicigera*, *Salvadora oleoides*, *Capparis aphylla*, *Tamarix articulata* grew in any abundance, *Zizyphus jujuba*, *Zizyphus nummularia*, were less common, and *Acacia arabica* and *Dalbergia sissu* were rarities. Grasses which grew after scanty rains provided grazing for numerous herds of cattle. Cultivation was unknown over this vast arid tract. During the last 40 years, thanks to the canals, the entire

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character of the locality—climatic, floral and faunal—has changed and Lyallpur has become one of the greenest parts of the Punjab, where innumerable trees provide roosting places, and different crops and fruit trees provide sufficient food for different species and enormous flocks of birds. The introduction of different types of plants as crops and fruit, shade and ornamental trees have brought in their particular pests and thus increased the food of the insectivorous birds.

If it were possible to compare the avian fauna of 40 years ago with what it is today, one would get most interesting facts regarding the 'Balance of Life in Nature'. Unfortunately, for want of record, such a comparison is not possible. As a direct result of the colonization of this arid area, undoubtedly, there has occurred an enormous increase in the numbers of such birds as crows, sparrows, parrots and pigeons, which now find abundant food and safe dwellings. This locality is still undergoing changes and a study undertaken after a quarter of a century will perhaps prove very interesting.

It may be stated that in addition to the birds mentioned in this paper, various species of cranes, mallards, ducks, teals and snipes are found in the Lyallpur District at the canal escapes at Chaku, Beranwala, Rodukoru and Bhakat, but as these birds are not of agricultural importance, they have not been studied.

The nomenclature adopted is that of Stuart Baker (*The Fauna of British India*). (F. No.....) indicates number of the species in the *Fauna* Volumes.

Some of the birds collected were identified by the Bombay Natural History Society and the help received is gratefully acknowledged.

BIRDS OF LYALLPUR.

The following is a brief account of the birds found at Lyallpur. Most of these were actually shot and their stomach contents examined.

Family: Corvidæ.

(1) **The Punjab Raven.** *Corvus laurencei*, Hume (F. No. 1).

Abundance.—Common in the vicinity of town as well as in the open country; found throughout the year; 19 birds killed during different months of the year.

Food.—Omnivorous: ripening fruits and cereals, seeds and seedlings from the fields; kitchen refuse; animal flesh; eggs and young of birds; insects—locusts, *Chrotogonus* spp., ants, gram caterpillars, cutworms, beetles, etc.

Status.—Of major importance to agriculture: on the whole harmful.

(2) **The Eastern Rook.** *Corvus frugilegus tschusii* Hartert. (F. No. 9).

Abundance.—A winter visitor; not common; 5 birds killed 21-2-1929 (3) and 5-12-1928 (2).

Food.—Wheat and other grains, tender shoots of gram, other vegetable matter; insects—ants, gram caterpillars, cutworms, beetles, etc.

Status.—Of minor importance to agriculture.

(3) **The Common Indian House-Crow.** *Corvus splendens splendens* Vieill. (F. No. 11).

Abundance.—Found in myriads throughout the year; numerous tall trees provide suitable roosts. In winter (October to March) they leave their roosting places every morning in huge flocks going towards different directions and return in the evening. Killed every week throughout the year 1928-29.

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Food.—Omnivorous: all kinds of ripening crops and fruits, seeds and seedlings, kitchen refuse, vegetables; lizards, eggs and nestling of birds; animal flesh; and insects—*Chrotogonus* spp., locust adults and hoppers, black ants, winged white-ants, caterpillars, beetles and beetle grubs, etc.

Examination of Stomach Contents.—Cropseeds 44.13 per cent, weedseeds 2.68 per cent, vegetables 7.33 per cent, cultivated fruits 6.46 per cent, wild fruits 5.39 per cent, animal flesh etc. 8.34 per cent, injurious insects 16.15 per cent, miscellaneous, bread etc., 9.47 per cent and pebbles 0.05 per cent.

Status.—A very important bird in agriculture: certainly a serious pest in the canal colonies; its total extermination perhaps may not be desirable, but its numbers must be kept down.

(4) **The Indian Tree-pie.** *Dendrocitta rufa rufa* Latham. (F. No. 26).

Abundance.—Not very common; 7 birds killed on 24, 26-4-1930, 30-6-1926, 1-7-1928 (2); 2-8-1928; 21-12-1928.

Food.—Omnivorous: cultivated crops; fruits; lizards, spiders, eggs and nestling of birds; and insects—locust hoppers, caterpillars, beetles, etc.

Family: PARIDÆ.

(5) **The Punjab Grey-Tit.** *Parus major planorum* Hartert (F. No. 54).

Abundance.—A rare bird; only one specimen was killed on 28-11-1929.

Food.—Ants and other hymenopterous insects.

Family: TIMALIIDÆ.

(6) **The Bengal Jungle-Babbler.** *Turdoides terricolor terricolor* Hodgs. (F. No. 183).

Abundance.—Fairly common; present throughout the year, seen hopping about bushes and trunks of trees and overturning leaves in search of insects; 31 birds killed during different months of the year.

Food.—Omnivorous: grains, seeds and seedlings, weedseeds; sometimes fruits; various insects—*Chrotogonus* spp., locust, eggs and hoppers, ants, caterpillars and beetles. Insects form the major portion of its diet.

Status.—Of major importance to agriculture: beneficial.

(7) **The Common Babbler.** *Argya caudata caudata* Dumont. (F. No. 192).

Abundance.—A familiar and common bird, seen throughout the year near bushes and hedges; 17 birds killed during different months of the year.

Food.—Mainly insects—ants, caterpillars, beetles; also grains, seeds and seedlings, and weedseeds.

Status.—Of major importance to agriculture: beneficial.

Family: PYCNONOTIDÆ.

(8) **The Punjab Red-vented Bulbul.** *Molpastes hæmorrhous intermedius* Jerdon. (F. No. 404).

Abundance.—Common; generally seen in pairs throughout the year in gardens and cultivated areas; 12 birds killed during different months of the year.

Food.—Omnivorous: grains, ficus-fruit, peas; insects—locust adults and hoppers, ants, winged white-ants, caterpillars, moths, beetles, etc.

Status.—Of minor importance to agriculture: on the whole beneficial.

(9) **The White-cheeked Bulbul.** *Molpastes leucogenys leucogenys* Gray. (F. No. 405).

Abundance.—Not so common as the above, one specimen killed on 5-9-1929.

Family: TURDIDÆ

(10) **The Northern Indian Stone-Chat.** *Saxicola caprata bicolor* Sykes. (F. No. 494).

Abundance.—Not very common; only 5 birds killed on 19-3-1928, 7, 26 (2)-8-1929 and 16-9-1928.

Food.—Insects—ants, beetles, etc.

(11) **The Pied Chat.** *Œnanthe picata* Blyth. (F. No. 506).

Abundance.—Not very common, a winter visitor; only 4 birds killed on 27-8-1931, and 3, 9, 12-12-1930.

Food.—Insects, mainly *Hymenoptera*—ants, also caterpillars, beetles, etc.

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(12) **Strickland's Chat.** *Œnanthe oenanthe opistholeuca* Strickland. (F. No. 508).
Abundance.—Not very common; only 4 birds killed on 4-1-1930 and 22, 28, 30-11-1929.
Food.—Insects—mainly *Hymenoptera*, e.g., ants, also beetles, etc.

(13) **The Isabelline Chat.** *Œnanthe isabellina* Cretzschm. (F. No. 512).
Abundance.—Rare: only 1 specimen killed on 28-8-1930.
Food.—Mainly insects.

(14) **The Eastern Indian Redstart.** *Phœnicurus ochrurus rufiventris* Vieill. (F. No. 532).
Abundance.—A common bird, but only a winter visitor; 10 birds killed on 3, 6 (2)-1-1930, 26-1-1928, 9, 15-11-1930, 28-11-1929, 4-12-1930 and 6, 15-12-1929.
Food.—With the exception of one bird the stomach contents consisted of mainly insects—ants and other *Hymenoptera*, caterpillars, beetles, etc.
Status.—Of minor importance to agriculture: beneficial.

(15) **The Western Red-spotted Blue-throat.** *Cyanosylvia succica suecica* Linn. (F. No. 536).
Abundance.—Rare; only 1 specimen killed on 11-4-1928.
Food.—Mainly insects—ants, cutworms, caterpillars and beetles.

(16) **The Brown-backed Indian Robin.** *Saxicoloides fulicata cambaiensis* Lath. (F. No. 557).
Abundance.—A common and most familiar bird; a permanent resident; 21 birds killed during all the different months of the year.
Food.—Various insects, mostly injurious—*Chrotogonus* spp., locust hoppers, white-ant workers, *Laphygma* sp. and other caterpillars, beetles, ants and other *Hymenoptera*.
Status.—Of major importance to agriculture: beneficial.

(17) **The Black-throated Thrush.** *Turdus atrogularis* Temm. (F. No. 578).
Abundance.—A winter visitor; not very common; 7 birds killed on 20, 21, 25-1-1928. 21-2-1928, 28-2-1930 and 16, 18-3-1930.
Food.—Mainly insects—locust eggs and hoppers, cutworms and other caterpillars, beetles, etc.

Family: MUSCICAPIDÆ.

(18) **The Indian Paradise Flycatcher.** *Terpsiphone paradisi paradisi* Linn. (F. No. 688).
Abundance.—A pair was seen in the summer on 20-6-1928 and a male bird in winter on 25-11-1931.
Food.—Mainly insects.

(19) **The White-browed Fantail Warbler.** *Rhipidura aureola aureola* Less. (F. No. 700).
Abundance.—Not very common, 6 birds were killed on 11-2-1928, 7-8-1929, 23-9-1928, 30-10-1930, and 18, 21-11-1929.
Food.—Mainly insects—*Chrotogonus* spp., ants and beetles.

Family: LANIIDÆ.

(20) **The Indian Grey Shrike.** *Lanius excubitor lahtora* Sykes. (F. No. 706).
Abundance.—Very common; is seen sitting on trees looking for insects on wing or on ground; 13 birds were killed during different months.
Food.—Insects—*Chrotogonus* spp., locust adults and hoppers, black ants and other *Hymenoptera*, *Agrotis* caterpillars, beetles and bugs, etc.
Status.—Of major importance to agriculture: beneficial.

(21) **The Bay-backed Shrike.** *Lanius vittatus* Valenc. (F. No. 710).
Abundance.—Common; 9 birds killed on 15, 20-3-1928, 5-4-1928, 22-5-1929, 3-7-1929, 17-8-1928, 26-11-1929, 14-12-1929 and 1-12-1930.
Food.—Insects—*Chrotogonus* spp., ants and other *Hymenoptera*, *Neuroptera*, cutworms and other caterpillars, beetles, etc.
Status.—Of major importance to agriculture: beneficial.

(22) **The Rufous-backed Shrike.** *Lanius schach erythronotus* Vigors. (F. No. 714).

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Abundance.—Common; 4 birds killed on 3-1-1930, 22-3-1930, 26-11-1929 and 23-12-1929.

Food.—Insects—locust hoppers, ants and other *Hymenoptera*, caterpillars, beetles, etc.

Status.—Of minor importance to agriculture: beneficial.

(23) **The Indian Common Wood-Shrike.** *Tephrodornis pondiceriana pondiceriana* Gmel. (F. No. 729).

Abundance.—Rare; only 1 specimen was killed on 29-11-1929.

Food.—Various insects—*Hymenoptera*, *Coleoptera*, etc.

Family: PERICROCOTIDÆ.

(24) **The Indian Short-billed Minivet.** *Pericrocotus brevirostris brevirostris* Vigors. (F. No. 738).

Abundance.—Not common; 6 birds killed on 8-1-1929, 17, 24-2-1928, 20-11 1929 (2) and 4-12-1928.

Food.—Buds of *kikar* (*Acacia arabica*), spiders, various insects—*Orthoptera*, ants and other *Hymenoptera*, caterpillars, beetles, flies, etc.

Family: DICRURIDÆ.

(25) **The Black Drongo or King Crow.** *Dicrurus macrocercus macrocercus* Vieill. (F. No. 766).

Abundance.—Most familiar and common bird, found throughout the year; 21 birds killed during all the different months of the year. It is seen perching on telegraph wires, trees, poles, backs of cattle, watching for insects, or sitting on clods in fields which are being irrigated, waiting for insects disturbed by water. It catches flying insects as well as those on the ground.

Food.—Insects—*Chrotogonus* spp., locust adults and hoppers, black ants, white-ants, moths, cutworms, *Laphygma* and other caterpillars, beetles, maggots, etc.

Status.—Very important bird to agriculture: positively beneficial.

Family: SYLVIIDÆ.

(26) **The Indian Tailor-Bird.** *Orthotomus sutorius sutorius* Forst. (F. No. 813).

Abundance.—Not common; 6 birds killed on 14-4-1928, 15-6-1926 (3), 27-7-1926 (2).

Food.—Insects such as flies, bees, etc.

(27) **The Rufous-fronted Wren-Warbler.** *Franklinia buchanani* Blyth. (F. No. 831).

Abundance.—Rare bird; only 2 killed on 7-8-1929 and 4-9-1929.

Food.—Mainly harmful insects.

(28) **The Brown Willow-Warbler.** *Phylloscopus collybitus tristis* Blyth. (F. No. 854).

Abundance.—A winter visitor; only 3 killed on 21-11-1929, 11-12-1929 and 11-12-1930.

Food.—Mainly harmful insects.

(29) **The Green Willow-Warbler.** *Acanthopneuste nitidus nitidus* Blyth. (F. No. 874).

Abundance.—A winter visitor; 3 birds killed on 2, 4-9-1929 and 17-12-1929.

Food.—Mainly insects—caterpillars, etc.

Family: ORIOLIDÆ.

(30) **The Indian Oriole.** *Oriolus oriolus kundoo* Sykes. (F. No. 953).

Abundance.—A rare bird, seen in pairs in gardens; 5 killed on 23-6-1926, 5, 15-7-1928, 26-7-1929 and 14-8-1931.

Food.—Ficus fruits and various insects—*Chrotogonus* spp. caterpillars, etc.

Family: STURNIDÆ.

(31) **The Rosy Pastor or Rose coloured Starling.** *Pastor roseus* Linn. (F. No. 972).

Abundance.—Appears in large flocks in the month of April and disappears in the same month, the nestlings visit again in July and remain here upto the first week of October; 76 birds killed during April, August and September.

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Food.—Mostly mulberry fruits, ficus fruits, grains of chari (*Andropogon sorghum*) and other similar crops; and various harmful insects—*Chrotogonus* spp., locust adults and hoppers, gram caterpillars and cutworms, other caterpillars, beetles, weevil adults and grubs, dipterous pupæ, etc. It is a great enemy of locust.

Status.—Very beneficial particularly during the locust years.

(32) **The Himalayan Starling.** *Sturnus vulgaris humii* Brooks. (F. No. 973).

Abundance.—Remains in flocks throughout the winter; 89 birds killed from August to April.

Food.—Small quantities of grains, fruits; lizards and spiders; large numbers of harmful insects—*Chrotogonus* spp. all stages of locust, gram caterpillars and cutworms, beetles, weevil and grubs, maggots, and *Chrysopa* sp. pupae. It is a great enemy of the gram caterpillars; one bird took 103 cutworms per meal. Practically all the birds killed had taken gram caterpillars and cutworms.

Status.—A most important bird to agriculture: beneficial.

(33) **The Common Myna.** *Acridotheres tristis tristis* Linn. (F. No. 996).

Abundance.—One of the most familiar and common bird; present in large numbers throughout the year; attends ploughing, hoeing, watering and other agricultural operations, picking up insects which are disturbed. It may be seen going round and peeping into bushes and plants for insects.

Food.—Ripening grains, seeds and seedlings, vegetables and various harmful insects—*Chrotogonus* spp., all stages of locust, ants, winged white-ants, adults of *Amsacta* sp., gram caterpillars, cutworms and other caterpillars, beetles, weevils and weevil grubs (*Hypera variabilis*), etc.

Examination of Stomach Contents.—Cropseeds 38.2 per cent; weedseeds 0.3 per cent; neutral seeds 0.1 per cent; vegetables 5.5 per cent; cultivated fruits 4.9 per cent; wild fruits 29.4 per cent; animal matter 0.7 per cent; injurious insects 20.1 per cent and pebbles 0.8 per cent.

Status.—Very important to agriculture: beneficial.

Family: PLOCEIDÆ.

(34) **The White-throated Munia.** *Uroloncha malabarica* Linn. (F. No. 1030).

Abundance.—Not very common; 4 birds killed on 20-1-1928, 31-3-1928, and 11, 28-11-1930. It is seen sitting on the top of *sarkanda* (*Saccharum spontaneum*), chari (*Andropogon sorghum*) and bajra (*Pennisetum typhoideum*) plants.

Food.—Grains, weedseeds, vegetable matter; and insects—ants, beetles, etc.

Status.—Of minor importance to agriculture: injurious.

Family: FRINGILLIDÆ.

(35) **The Yellow-throated Sparrow.** *Gymnoris xanthocollis xanthocollis* Burton (F. No. 1094).

Abundance.—Not very common; 6 birds killed on 16-2-1928, 4-4-1928 (2), 27-4-1931, 8-5-1928 and 27-8-1929.

Food.—Grains, weedseeds, vegetable matter; and insects—ants, beetles, etc.

(36) **The Indian House-Sparrow.** *Passer domesticus indicus* Jard. & Selby. (F. No. 1096).

Abundance.—A permanent resident, found in abundance throughout the year. Attacks in very large flocks the ripening cereals—wheat, chari (*Andropogon sorghum*), bajra (*Pennisetum typhoideum*), and rice (*Oryza sativa*) etc.; 262 birds killed throughout the different months of the year.

Food.—Ripening crops and fruits, tender shoots, flowers, vegetables, weedseeds; in the breeding season insects mostly caterpillars, also ants in small numbers, locust hoppers.

Examination of Stomach Contents.—Cropseeds 73.1 per cent; weedseeds 4.2 per cent; vegetables 0.4 per cent; insects 2.6 per cent; and pebbles 19.7 per cent.

Status.—A very important bird to agriculture: very injurious.

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(37) **The Red-headed Bunting.** *Emberiza icterica* Eversm. (F. No. 1134).
Abundance.—Not common; 2 birds killed on 11-4-1928 and 11-12-1930.
Food.—Grains and seeds.

Family: HIRUNDINIDÆ.

(38) **The Common Swallow.** *Hirundo rustica rustica* Linn. (F. No. 1152).
Abundance.—Rare; one bird killed on 25-12-1929.
Food.—Insects.

(39) **The Indian Wire-tailed Swallow.** *Hirundo smithii filifera* Stephens. (F. No. 1157).
Abundance.—Rare bird; was seen on 27-7-1931.
Food.—Insects.

Family: MOTACILLIDÆ.

(40) **The Indian White Wagtail.** *Motacilla alba dukhunensis* Sykes. (F. No. 1166).
Abundance.—Common and remains from September to first week of May; 21 birds killed on 2, 18, 22-1-1928, 2-5-1928, 18 (2), 19-10-1928, 5, 8, 13, 19-11-1928, 21-11-1929, 19, 25, 26, 29-11-1930 and 14, 16-12-1929.
Food.—Mostly insects—*Chrotogonus* spp., ants and other *Hymenoptera*, gram caterpillars, cutworms and other caterpillars, adults and grubs of *Hypera variabilis*. Few birds took grass seeds, grains and weedseeds.
Status.—Of major importance to agriculture: beneficial.

(41) **The Indian Pipit.** *Anthus richardi rufulus* Vieill. (F. No. 1195).
Abundance.—Not very common; 5 birds killed on 20, 27-3-1928, 26-3-1930, 5-4-1928 and 23-12-1929.
Food.—Mainly insects—Orthoptera, locust hoppers, Vespidæ, gram caterpillars and cutworms, beetles, weevils and dipterous pupæ.
Status.—Of some importance to agriculture: beneficial.

Family: ALAUDIDÆ.

(42) **Franklin's Crested Lark.** *Galerida cristata chendoola* Franklin. (F. No. 1237).
Abundance.—Not very common; 5 birds killed on 20, 27-3-1928, 26-3-1930, 17-11-1930, 7-12-1928 and 20-12-1929.
Food.—Grains, weedseeds and insects—locust hoppers, ants, cutworms, etc.

(43) **The Ashy-Crowned Finch-Lark.** *Pyrrhulauda grisea* Scop. (F. No. 1245).
Abundance.—Rare; one bird killed on 25-8-1931.
Food.—Omnivorous, feeds mostly on grains.

Family: NECTARINIIDÆ.

(44) **The Indian Purple Sunbird.** *Leptocoma asiatica asiatica* Lath. (F. No. 1278).
Abundance.—A summer visitor, commonly seen on flowers; 6 birds killed on 29-3-1928 (2), 19-4-1928 and 5, 24, 28-5-1928.
Food.—Mostly honey and insects, also spiders.

Family: PICIDÆ.

(45) **The Northern Golden-backed Woodpecker.** *Brachypternus benghalensis benghalensis* Linn. (F. No. 1394).
Abundance.—A familiar bird, commonly seen climbing on trees; 12 birds killed on 10, 12-3-1928, 10-4-1930, 14, 28-6-1926, 12-7-1928, 19-8-1926 (2), 1-8-1928, 26, 27-11-1929 and 10-12-1928.
Food.—Insects—mostly black ants, *Chrotogonus* spp., grasshoppers, caterpillars, moths, beetles, bugs, etc.
Status.—Of major importance to agriculture: beneficial.

(46) **The European Wryneck.** *Iynx torquilla torquilla* Linn. (F. No. 1423).
Abundance.—Rare; only 1 bird was killed on 26-8-1929.
Food.—Insects.

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Family: CUCULIDÆ.

(47) **The Common Hawk-Cuckoo.** *Hierococcyx varius* Vahl. (F. No. 1458).
Abundance.—Rare; only 3 birds were shot on 9-4-1928, 24-4-1930 and 8-7-1928.
Food.—Insects, many harmful species such as locust hoppers, grasshoppers, winged white-ants, enormous quantity of cutworms, other caterpillars, etc.

(48) **The Pied Crested Cuckoo.** *Clamator jacobinus jacobinus* Bodd. (F. No. 1472).
Abundance.—Rare; only 3 birds killed on 27-6-1929, 1-7-1928 and 22-8-1929.
Food.—Grasshoppers, winged white-ants and other insects.

(49) **The Indian Koel.** *Eudynamis scolopaceus scolopaceus* Linn. (F. No. 1475).
Abundance.—Arrives in the first week of March and remains upto early October; 7 birds killed on 17, 18, 25, 30-6-1926, 24-7-1926, 6-7-1928 and 9-8-1926.
Food.—Mostly ficus fruits and sometimes *Ber* (*Zizyphus jujuba*) and other fruits.
Status.—Of some importance as an enemy of crow's eggs.

(50) **The Common Crow Pheasant or Coucal.** *Centropus sinensis sinensis* Stephen. (F. No. 1490).
Abundance.—Not very common; lives in clumps of bamboos and in thick sugar-cane fields; 4 birds killed on 27-3-1928, 30-5-1929 and 30-6-1926 (2).
Food.—Mainly insects, including some noxious species—*Chrotogonus* spp., *Hymenoptera*, gram caterpillars, cutworms, maggots, etc.; also lizards, snakes, mice, bats and eggs of birds.
Status.—Of minor importance to agriculture: beneficial.

Family: PSITTACIDÆ.

(51) **The Large Indian Paroquet.** *Psittacula eupatria nepalensis* Hodgs. (F. No. 1497).
Abundance.—A very common bird, moves about in large parties towards cultivated area in the morning; returns before noon: again leaves in the afternoon and returns in the evening to spend the night at the roosting place.
Food.—A gregarious feeder; attacks various ripening crops specially wheat, maize, chari (*Andropogon sorghum*), toria (*Brassica campestris*), paddy (*Oryza sativa*) etc. and also attacks all kinds of fruits particularly citrus, guavas, figs, etc. It also takes vegetables and weedseeds. Its feeding habits are extremely wasteful as it cuts off much more than it can consume.
Examination of Stomach Contents.—Cropseeds 52 per cent, weedseeds 2.7 per cent; neutral seeds 11.4 per cent, vegetables 4.8 per cent, cultivated fruits 19.3 per cent; wild fruits 9.791 per cent and pebbles 0.009 per cent.
Status.—Of great importance to agriculture and horticulture: extremely harmful.

(52) **The Rose-ringed Paroquet.** *Psittacula krameri manillensis* Bechst. (F. No. 1500).
Abundance.—Same as above.
Food.—Same as above.
Status.—Of great importance to agriculture: extremely harmful.

Family: CORACIIDÆ.

(53) **The Indian Roller.** *Coracias benghalensis benghalensis* Linn. (F. No. 1517).
Abundance.—Very common throughout the year; 19 birds killed during different months. It is seen perching on trees, telegraph wires, poles, and sometimes on the backs of cattle, and dashes for insects in air or on ground, picks up its victim and returns to the perch to eat.
Food.—Insects—*Chrotogonus* spp., crickets, locust adults and hoppers, enormous number of winged white-ants, black ants and other *Hymenoptera*, beetles; also lizards, frogs and mice.
Status.—Very important to agriculture: beneficial.

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Family: MEROPIDÆ.

(54) **The Common Indian Bee-eater.** *Merops orientalis orientalis* Lath. (F. No. 1523).

Abundance.—A common bird, arrives in the last week of February and remains here for breeding uptill October; 9 birds killed on 22, 24-2-1928, 8, 27-5-1928, 14, 15-6-1926, 16-6-1931, 6-9-1929 and 7-9-1931.

Food.—Mainly insects—ants, bees, other *Hymenoptera*, dragon flies, moths, beetles, etc.

(55) **The Blue-tailed Bee-eater.** *Merops superciliosus javanicus* Horsf. (F. No. 1526).

Abundance.—Not very common; only 2 birds were killed on 14-7-1931 (2).

Food.—Dragon flies and some other insects.

Family: ALCEDINIDÆ.

(56) **The White-breasted Kingfisher.** *Halcyon smyrnensis smyrnensis* Linn. (F. No. 1550).

Abundance.—Common throughout the year; 17 birds killed during different months.

Food.—Insects—*Chrotogonus* spp., grasshoppers, gryllids, caterpillars, beetles, aquatic bugs, etc.

Status.—Of minor importance to agriculture: beneficial.

Family: UPUPIDÆ.

(57) **The Indian Hoopoe.** *Upupa epops orientalis* Stuart Baker. (F. No. 581).

Abundance.—Common and is generally seen throughout the year haunting grassy and cultivated fields; 21 birds killed during different months.

Food.—Mainly insects—*Forficulidæ*, *Chrotogonus* spp., locust hoppers, ants, gram caterpillars, cutworms and other caterpillars, beetles and beetle grubs, etc.

Status.—Of major importance to agriculture: beneficial.

Family: TYTONIDÆ.

(58) **The Indian Barn-Owl.** *Tyto alba javanica* Gmelin. (F. No. 1636).

Abundance.—Not very common; only 3 birds killed on 9-4-1928, 26-4-1929, and 3-6-1926.

Food.—Mice and insects.

Status.—Of minor importance to agriculture: beneficial.

Family: ASIONIDÆ.

(59) **The Central Indian Collared Scops-Owl.** *Otus bakkamœna marathæ* Ticehurst. (F. No. 1667).

Abundance.—Rare; only 2 birds killed on 11-5-1931 (2).

Food.—Mice; beetles and other insects.

(60) **The Northern Spotted Owlet.** *Athene brama indica* Frankl. (F. No. 1684).

Abundance.—Common throughout the year; 25 birds killed during different months.

Food.—Insects—*Chrotogonus* spp., gryllids, locust adults and hoppers, winged white-ants, ants, caterpillars, moths, beetles, maggots, etc. Its favourite food is beetles and it also takes mice.

Status.—Of major importance to agriculture: beneficial.

Family: ÆGYPIIDÆ.

(61) **The Cinereous Vulture.** *Ægypius monachus* Linn. (F. No. 1705).

Abundance.—Common throughout the year; one was killed on 26-3-1928.

Food.—Flesh of carrion.

Status.—Scavenger.

(62) **The Himalayan Griffon.** *Gyps himalayensis* Hume. (F. No. 1709).

Abundance.—Not common; only 1 was killed on 9-1-1930.

Food.—Carrion; dung; and insects such as locust hoppers.

Status.—Scavenger.

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Family: FALCONIDÆ.

(63) **The Laggar Falcon.** *Falco jugger* Gray. (F. No. 1721).
Abundance.—Rare; only 3 birds killed on 5-1-1929, 29-3-1928, and 11-4-1929.
Food.—Pigeons and other birds; locust and other insects.
Status.—Enemy of birds.

(64) **The Red-headed Merlin.** *Falco chiquera chiquera* Dauden. (F. No. 1730).
Abundance.—Rare; only 2 specimens killed on 4-1-1929 and 16-3-1928.
Food.—Birds; locusts, other insects.
Status.—Enemy of birds.

(65) **The Eastern Steppe-Eagle.** *Aquila nipalensis nipalensis* Hodgs. (F. No. 1748).
Abundance.—Rare; only 1 specimen was killed on 9-1-1929.
Food.—Small mammals, birds and reptiles.

(66) **The White-eyed Buzzard-Eagle.** *Butastur teesa* Frankl. (F. No. 1774).
Abundance.—Not very common; only 3 birds killed on 26-3-1928, 4-5-1928 and 14-6-1929.
Food.—Mice; various harmful insects—*Chrotogonus* spp., rice grasshopper, gryllids, caterpillars, beetles, etc.
Status.—Of minor importance to agriculture.

(67) **The Common Pariah Kite.** *Milvus migrans govinda* Sykes. (F. No. 1787).
Abundance.—Very common throughout the year; 3 birds killed on 4-1-1929, 15-3-1930 and 15-4-1930.
Food.—Kitchen and animal refuse, mice, lizards, small birds, chickens; various insects such as locust adults and hoppers.
Status.—Of major importance to agriculture: injurious to poultry.

(68) **The Indian Shikra.** *Astur badius dussumieri* Temm. (F. No. 1803).
Abundance.—Not very common; 6 birds killed on 28-4-1930, 26-6-1926, 30-7-1926, 2, 9-8-1926 and 10-11-1926.
Food.—Pigeons and other birds, mice, rats, lizards; and insects such as mantids, locust hoppers and adults, grasshoppers, winged white ants, etc.

(69) **The Northern Besra Sparrow-Hawk.** *Accipiter virgatus affinis* Hodgs. (F. No. 1814).
Abundance.—Not very common; 3 birds killed on 14-1-1929, 19-3-1930 and 28-4-1930.
Food.—Birds, lizards and insects such as locust.

Family: COLUMBIDÆ.

(70) **The Bengal Green Pigeon.** *Crocopus phœnicopterus phœnicopterus* Lath. (F. No. 1826).
Abundance.—Rare bird; only a few birds were seen in King's garden on 10-9-1931, but could not be killed.
Food.—Mostly ficus fruits.

(71) **The Indian Blue Rock-Pigeon.** *Columba livia intermedia* Strick. (F. No. 1856).
Abundance.—A very common bird, congregates in very large flocks and roosts in buildings—dwelling houses, mosques, temples and offices; leaves roosting places in the morning and returns before noon and again leaves in the afternoon and returns in the evening. On its return it visits tanks to drink water.
Food.—Takes food as gleanings, picks up seeds of crops especially wheat and maize, germinating crops, weedseeds and pebbles.
Examination of Stomach Contents.—Cropseeds 66.15 per cent; weedseeds 30 per cent and pebbles 3.85 per cent.
Status.—Of major importance to agriculture: very injurious.

(72) **The Indian Spotted Dove.** *Streptopelia chinensis suratensis* Gmel. (F. No. 1873).
Abundance.—A rare bird; two pairs seen since 1926 and 1 bird killed on 20-1-1929.
Food.—Grains, weedseeds and fruits.

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(73) **The Indian Little Brown Dove.** *Streptopelia senegalensis cambaiensis* Gmelin. (F. No. 1877).

Abundance.—Common, found throughout the year; 14 birds killed during different months.

Food.—Grains, weedseeds, seeds sown, germinating crops and pebbles.

Status.—Of minor importanec to agriculture: injurious.

(74) **The Indian Ring-Dove.** *Streptopelia decaocta decaocta* Frivalszky. (F. No. 1879).

Abundance.—Very common throughout the year. At the time of thrashing of toria (*Brassica campestris*) seen in abundance in such fields.

Food.—Grains as gleanings, seeds sown and germinating crops, pebbles Only two or three birds took one insect each.

Examination of Stomach Contents.—Cropseeds 64.97 per cent; weedseeds 30.58 per cent; vegetable matter 1.18 per cent; insects 0.06 per cent and pebbles 3.21 per cent.

Status.—Of major importance to agriculture: injurious.

(75) **The Indian Red Turtle-Dove.** *Œnopopelia tranquebarica tranquebarica* Henry. (F. No. 1881).

Abundance.—A summer visitor; 6 birds killed on 7-5-1931 (2), 16-6-1931, 19-8-1928 (2) and 8-8-1929.

Food.—Same as above.

Status.—Of minor importance to agriculture: injurious.

Family: PTEROCLIDÆ.

(76) **The Common Indian Sand-Grouse.** *Pterocles exustus erlangeri* Neum. (F. No. 1893).

Abundance.—A rare bird; a few were seen on barren land near Narwala in August, 1929.

Food.—*Guara* (*Cyamopsis psoralioides*) seeds and other grains.

Family: PHASIANIDÆ.

(77) **The Common Peafowl.** *Pavo cristatus* Linn. (F. No. 1897).

Abundance.—Introduced; eggs brought from Hoshiarpur; only 1 or 2 birds seen in the King's garden.

Food.—Grains, vegetables, fruits; insects such as locust hoppers, caterpillars, beetles, etc.; also takes frogs, lizards and snakes.

(78) **The Common** or **Grey Quail.** *Coturnix coturnix coturnix* Linn. (F. No. 1950).

Abundance.—Visits in very large numbers in April and August to September; 16 birds killed on 14-3-1927 (2), 14-4-1928, 3-9-1929 (3) and 11 (5), 13 (5),-9-1931.

Food.—Grains, weedseeds, insects—ants, caterpillars, *Hypera variabilis* grubs, beetles, aphids, etc.

(79) **The Northern Chukar.** *Alectoris græca pallescens* Hume. (F. No. 1974).

Abundance.—Not found in open country, but kept as a cage bird.

Food.—Omnivorous.

(80) **The Indian Black Partridge.** *Francolinus francolinus asiæ* Bonap. (F. No. 1976).

Abundance.—Not found in the open country, but is a favourite cage bird.

Food.—Grains, weedseeds; and various insects such as locust hoppers, etc.

(81) **The Northern Grey Partridge.** *Francolinus pondicerianus interpositus* Hartert. (F. No. 1984).

Abundance.—Rare; 10 birds killed on 27-3-1930, 2-4-1930 (2), 12, 26-6-1926 and 4 (2), 17, 21, 24-7-1928.

Food.—Grains, seeds, weedseeds, vegetable matter; and insects—locust hoppers, ants, winged white-ants and workers, beetle grubs, etc.

Status.—Of major importance to agriculture: beneficial.

Family: TURNICIDÆ.

(82) **The Little Button-Quail.** *Turnix dussumieri* Temm. (F. No. 2003).

Abundance.—Rare; only 1 bird was shot on 14-4-1928.

Food.—Grains, weedseeds and insects.

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Family: RALLIDÆ.

(83) **The Coot.** *Fulica atra atra* Linn. (F. No. 2029).
Abundance.—Rare; only 1 specimen was shot on 16-2-1928.
Food.—Germinating crops and insects.

Family: GLAREOLIDÆ.

(84) **The Cream-Coloured Courser.** *Cursorius cursor cursor* Latham. (F. No. 2051).
Abundance.—Rare; 6 specimens shot on 13-2-1930 and 4 (2), 8 (3)-12-1929.
Food.—Ants and other *Hymenoptera*, gram caterpillars and other caterpillars, beetles, etc.

Family: STERNIDÆ.

(85) **The Gull-billed Tern.** *Gelochelidon nilotica nilotica* Gmelin. (F. No. 2072).
Abundance.—Rare; 2 specimens killed on 11-8-1931 (2).
Food.—Frogs, *Crustacea* and insects.

Family: CHARADRIIDÆ.

(86) **The Chinese Little Ringed Plover.** *Charadrius dubius dubius* Scop. (F. No. 2113).
Abundance.—Rare; 2 birds killed on 19-3-1930 (2).
Food.—Insects—*Chrotogonus* spp., *Hypera variabilis* grubs, beetles, etc.

(87) **The Indian Red-wattled Lapwing.** *Lobivanellus indicus indicus* Bodd. (F. No. 2125).
Abundance.—Not common, although a permanent resident; 6 birds killed on 11-1-1928, 15-3-1928, 13-8-1928 (2), 27-10-1926 and 8-12-1928.
Food.—Insects—ants, caterpillars, beetles, etc. Two birds took green vegetable matter.

(88) **The Yellow-wattled Lapwing.** *Lobipluvia malabarica* Bodd. (F. No. 2128).
Abundance.—Rare and was seen in August, 1928.
Food.—Insects.

Family: SCOLOPACIDÆ.

(89) **The Green Sandpiper.** *Tringa ochrophus* Linn. (F. No. 2143).
Abundance.—Not very common, is seen near tanks; 7 birds killed on 7 (2) 19 (2)-8-1926, 28, 29-8-1928 and 5-11-1926.
Food.—Mosquitoe larvae and other un-identifiable insects.

(90) **The Ruff and Reeve.** *Philomachus pugnax* Linn. (F. No. 2152).
Abundance.—A rare bird; only 3 specimens killed on 13-8-1928 (2) and 29-11-1929.
Food.—Insects—*Hymenoptera*, beetles and mosquitoe larvae and pupae, etc.

Family: ARDEIDÆ.

(91) **The Cattle Egret.** *Bubulcus ibis coromandus* Bodd. (F. No. 2226).
Abundance.—Rare bird, was seen in flocks twice or thrice attending cattle; 4 birds killed on 29-7-1928 (2) and 7-9-1929 (2).
Food.—Insects—*Chrotogonus* spp., grasshoppers, beetles, etc. Two birds took lizards and one bird took one frog.
Status.—Of minor importance to agriculture: beneficial.

(92) **The Indian Pond-Heron.** *Ardeola grayii* Sykes. (F. No. 2229).
Abundance.—Common near ponds and watered fields, permanent resident; 8 birds killed on 13-1-1928, 10, 16-2-1928, 19-6-1926, 7-8-1926, 18-8-1931, 16-10-1928 and 7-11-1930.
Food.—Insects—*Chrotogonus* spp., grasshoppers, crickets, earwigs, *Hymenoptera* (e.g., ants), caterpillars, beetles, etc.; and also took spider, fish and frog.

(93) **The Night Heron.** *Nycticorax nycticorax nycticorax* Linn. (F. No. 2233).
Abundance.—Rare; only 1 specimen was shot on 29-8-1929.
Food.—Fish, frogs, *Crustacea* and insects.

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Photo: *C. McCann.*

The Bloodsucker (*Calotes versicolor*). A large male.

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NOTES ON *CALOTES VERSICOLOR* (DAUDIN) JERDON.

BY

CHARLES MCCANN, F.L.S.

(*With* 3 *plates*).

The BLOODSUCKER is so common an inhabitant of almost every garden in India, that it is frequently referred to as the 'garden lizard'. How it ever came by the name of Bloodsucker is difficult to say, for it could not 'suck' even if it would; and the choice of this name is certainly more unfortunate than that of 'chameleon' which is commonly used for this lizard by the Europeans in Indo-China. This *Calotes* is not the Chameleon, but it is rightfully entitled to its specific designation *versicolor* or 'colour-changing', because it can change its colour to some extent under ordinary circumstances, and does change it very much during the breeding season.

As a rule the Bloodsucker, either male or female, is by no means conspicuous. Not that it remains in hiding, for it takes keen delight in warmth and light and may be seen in the open basking in the morning sun, on the alert for some unwary prey. Light brown or greyish, with or without a greenish tinge and indistinct dark spots or streaks, its colour easily blends with the varied hues of the surroundings, while the general outline and the peculiar favourite attitude assumed when at rest further contribute to render the animal invisible to all but experienced eyes.

During the cold season bloodsuckers seek shelter in hollow trunks or holes in the ground, or enter houses where they hide behind furniture and curtains. They only emerge from their retreat during the hottest part of the day to bask in the sun and indulge in short spell of exercise. As the weather becomes genial and warmer they come out more often, until finally they settle down for good in the open where they spend the summer months.

The breeding season is heralded by a remarkable change of colour. While the female is satisfied with a slight maidenly blush, the male dons the most extraordinary polychromous attire, the head, the shoulders, a portion behind the shoulders, and a part of the forelegs become brilliant crimson or bright scarlet; black patches appear on either side of the throat, at the angle of the jaw, and the shoulder.

Thus grotesquely, some say gorgeously, painted the male sits on a fence post or on the trunk of a tree surveying the neighbourhood. By now its manners are as loud as its dress, and its sole intent is to seek a quarrel. It will from time to time distend its gular membrane and jerk its head and shoulders up and down, as an acrobat practising the 'dunds' by way of exercise. But this is not a mere physical exercise, it is to all intents and purposes a provocation, a challenge to all the males

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in the vicinity. And as every male is now urged by the same pugnacious spirit many fights take place with much 'all-in' wrestling and biting.

Two males about to fight will first charge each other from a distance as did the warriors of old. They then gradually approach and finally rush at one another for the grip. On meeting, both stand on the hind legs and tail, hold each other with the forelegs and endeavour to bite. Toes or a portion of the tail are often bitten off in the encounter; and a number of scratches and wounds on various parts of the body certify to the vigour of the combat. However, even with lizards, there is such a thing as shamming; and, very often the fight stops abruptly as one of the duellists believes that flight is safer than fury and runs away before much damage has been done. The victor asserts his territorial rights and becomes the uncontested monarch of all he surveys.

Sexual variation:—Except for the remarkable difference of colour during the breeding season this lizard exhibits little sexual variation. It may, however, be noted that the adult male is appreciably larger than the female, that in the adult male the base of the tail is markedly swollen, and that owing to the presence of larger muscles the lower jaw of the male forms a characteristic curve while that of the female runs in an almost straight line.

Sexual activity:—The breeding season starts in April and ends in September. Mating is frequent from the second half of April to the end of June and the early part of July.

[Annandale (1900) has given an account of the courtship of this lizard. He says that 'The males are very pugnacious and change colour as they fight. At the time of courtship a curious performance is gone through by the male, the female remaining concealed in the foliage hard by. He chooses some convenient and conspicuous station and advances slowly towards the female. His colour then is pale yellowish flesh-colour, with a conspicuous dark spot on the gular pouch, which is extended to its utmost. He stands upright, raising the fore-part of the body as high as possible and nodding his head solemnly up and down. As he does so, the mouth is rapidly and repeatedly opened and shut. When he is driven away, caught or killed, the dark spot disappears entirely from the neck. If one male is captured another takes his place in a few hours.' [*F.B.I.* (*Reptilia*), 2nd. ed., p. 192.]

Dr. Annandale's mention of the total disappearance of the dark spot on the gular pouch needs explanation. There are two such black spots, one on either side of the neck; they are usually clearly defined, and particularly so during the breeding season. When the gular pouch is distended these spots are very conspicuous, often showing a narrow white ring around; but, and this is the point to be emphasized, on contraction of the pouch—as is the case with fear and death—they disappear into the folds of the neck and become invisible. This is evidently what Dr. Annandale meant; for he must have been aware of the existence of pigmented

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cells and of the persistence of the pigment, even after death. As a matter of fact the old spirit specimens found in the collections of the Bombay Natural History Society still show the spots.

As for the bowings and noddings of the head they may be observed at all times and can be produced by other emotions as well as by sexual excitement. If disturbed, bloodsuckers will bow and nod their heads exactly as when courting. Personally I believe it is a threatening attitude which serves the animal for purposes both offensive and defensive. On the other hand Father Caius is of the opinion that this bowing and nodding is primarily due to the peculiar anatomical structure of the fore-limbs which makes it impossible for the lizard to erect its head and the fore-part of its body for any length of time.

Pairing takes place either on the ground or on the vertical trunk of some tree. At the time of mating the male grips the female with his jaws by the ridge at the back of her neck and, while tightening his embrace, shoots his tail and the posterior end of his body under her. Within a second copulation is over and the animals have separated.

I am indebted to Mr. Sālim Ali for the following account of a pairing which occurred at Kihim on the 12th June 1930.—'After copulation the male ran off some distance and climbed half way up a post; while the female crawled away slowly in aimless fashion, her gait being strikingly similar to that of a walking chameleon. She retained her colour (bright orange-red with two blue-black patches under the neck where the fore-limbs join the body). Not so the male who turned quite pale and only retained the blue-black patches, though in a very much attenuated hue. The female kept crawling about for some twenty minutes, when she was seen to put her nose to the ground as if scenting, and then scratching the earth with only one forepaw at a time. As she was thus engaged the male popped up from behind a stone near by; he was still pale, but as he closed upon her his colours became gradually more vivid and were again quite intense by the time he grabbed her by the neck. She now dragged him to the trunk of a neighbouring mango tree and pulled him up some two feet above the ground, when she surrendered for the second time. After separating the pair remained on the trunk, a few inches apart; the male almost colourless, the female as bright as ever. In another twenty minutes the animals copulated for the third time; the male, completely colourless by now, ran some way up the tree; and the female climbed down to the ground, crawled about for a bit—when she again put her nose down and halted at the place where she had previously pawed, and finally ran half-way up the pole where the male had taken up his position after the first act.'

Egg-laying:—In gardens, the favourite sites for the deposition of eggs are flower beds, flower pots and manure heaps, where the earth is easily scratched out. Away from gardens, any spot where the earth is soft is selected as a suitable site. The 'nest' may be just a trough or a hole from 2 to 7 inches deep, though shallow holes are more frequently selected. When laid in a trough, the

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eggs are loosely packed; but if in a hole, they are tightly rammed and this often results in the alteration of their shape. I have repeatedly unearthed eggs, but have never seen actual deposition in progress. However, my neighbour, Mrs. C. Mason, who witnessed a Bloodsucker laying her eggs, described it as follows: 'The lizard came down from the garden wall, went straight to a flower bed, scooped a hole in the earth 3-4 inches deep with her forelegs. She then sat on the edge of the scoop and dropped the eggs in one by one. After a few eggs had been laid, I went closer to watch the proceedings, but the lizard took fright and ran away leaving the eggs uncovered. I counted six eggs and withdrew to a point from which I could observe without being seen. Soon, the lizard returned and completed her egg-laying. When she had finished, she covered over the eggs with earth, smoothed the surface out so as to defy detection and went away. The time taken by the lizard was two hours (including the disturbance) —from 12.30 to 2.30 p.m.' Mrs. Mason marked the spot with a stone and told me about the occurrence the same evening. A week later I dug up the spot only to find the shells left, as ants had eaten the contents. The incident referred to above occurred on the 23rd July (1937). Prior to this, I found 17 eggs in almost the identical spot, on the 24th June.

Eggs:—The eggs are small ellipsoid bodies with a soft chalky white shell. They are not stuck together as is often the case with reptile eggs. When freshly taken from the 'nest' the shape may vary somewhat from the ellipsoid but this is due to pressure as they are frequently tightly packed, but when allowed to stand for a while they become elliptic once more. Eggs from different clutches vary considerably in size but those of the same clutch are fairly regular. On the 22nd August (1937), I dug out two clutches, one of 21 eggs and another of 18. The average measurements of the former were 16.8 × 12.6 mm. (largest 19 × 13 mm., smallest 15 × 12 mm.), and of the latter, 12.4 × 8.3 mm. (largest 13.5 × 9 mm., smallest 11.5 × 9 mm.). These measurements are not in accordance with those recorded by Asana (10-11 × 5.4 mm.) nor with those mentioned by Dr. Malcolm Smith in the *F.B.I., Reptilia,* 2nd. ed., vol. ii, p. 193 (14-15 mm. long by 8-9 mm. broad). However, this only shows the great variation in size and I am in full agreement with Dr. Smith's remark 'the age and size of the parent are important factors in egg-production'. Eggs kept under observation increased 2-3 mm. in size just before the young hatched out. Eggs on being placed in preservatives shrink considerably.

Again, with regard to the number of eggs deposited at a time there seems to be a conflict of opinion. The largest number of eggs I have found in a clutch is 23. Above I referred to two clutches, one of 21 and the other of 18. On the 23rd August (1937) I obtained another clutch of 14 in my garden and a couple of days later a clutch of 15. So far I have never come on a clutch of less than 8. Dr. Smith (*loc. cit*) writes 'I have never known them to be buried more than a couple of inches below the earth, and the number deposited may vary from 4 to 12.' I am

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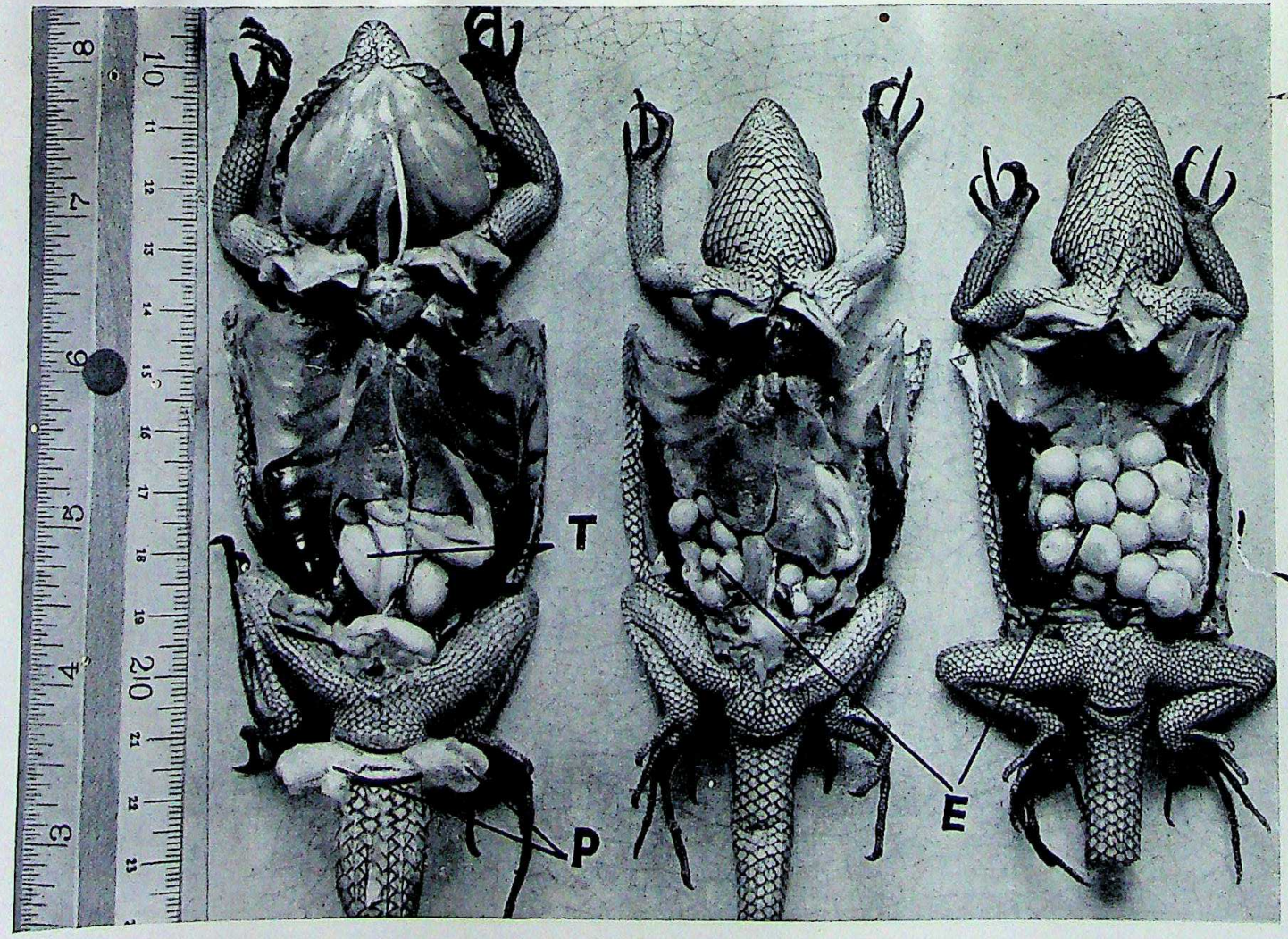

Photo t C. McCann.

The Bloodsucker (*Calotes versicolor*). Dissections showing condition of the reproductive organs in June. E. eggs; P. hemipenis, T. testes. (*Scale in millimetres and inches*).

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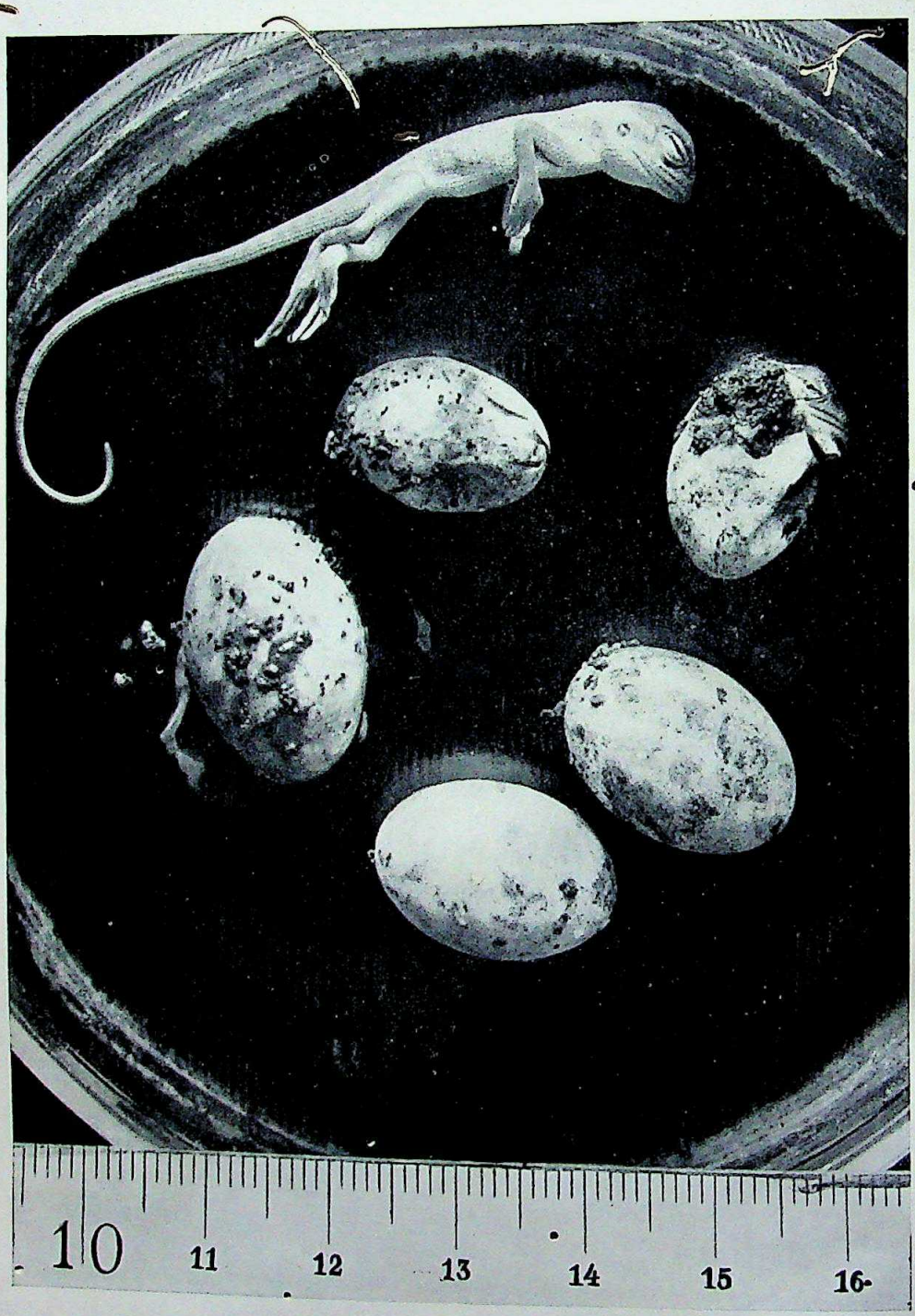

Photo: *C. McCann.*

The Bloodsucker (*Calotes versicolor*) showing eggs:—hatching and newly hatched. (*Scale in millimetres*).

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inclined to believe that a single female lays more than the recorded number of eggs in one season, as dissected females show many more eggs in the ovaries; but all these eggs do not mature at once, and consequently are not laid at the same time. Perhaps the first clutch is the largest and subsequent clutches are smaller. On the 14th October (1937) I obtained 3 further clutches of largish eggs with embryos of various age. The freshest had embryos about one-third incubated. However this point needs further observation.

Incubation:—On the 24th June (1937) Mrs. Mason saw a Bloodsucker covering up her eggs in a flower bed and informed me of it. I dug up 17 eggs from the spot and kept them to hatch out. On the 31st July (37 days) two young hatched out. The next day (38 days) the greater number hatched and the day after (39 days) all were out, with the exception of one egg which was bad. This gives us a period of 37-39 days. Prof. Asana, in his interesting article on the Natural History of *Calotes versicolor,* writes 'The majority of the eggs that have been thus treated in our laboratory hatched after of period of not less than 42 nor more than 45 days.' There is a difference of a week between the two observations, but this appears to me a trivial point as climatic conditions probably influence the period of incubation.

When hatching, the young lizard cuts several irregular and oblique slits in the thin shell at one pole. F. E. W. Venning in an interesting note published in vol. xxi, p. 690 [Some notes on the hatching of the agamoid Lizard (*Calotes jerdoni*)] states that he observed an egg-tooth in the case of the species described. Replying to Venning's note Dr. Annandale (xxi, p. 1099) The Rupture of the Egg-shell in the Genus *Calotes* writes 'but I can find no trace of an egg-tooth in my specimens (*Calotes nigrilabris*), and indeed, it is hard to see how a structure of that nature could produce the oblique slits and triangular flaps so clearly shown in his (Venning's) figures. My own opinon is that the slits are produced by the long claws of the forefoot.'

I have examined several embryos of *Calotes versicolor* at different stages, including the young lizards about to cut the shell and I can find no trace of an egg-tooth. The shells are split open by the claws as suggested by Dr. Annandale. It seems curious that in two species of the same genus no egg-tooth has been observed while in *C. jerdoni* it has been seen (above).

Method of artificial hatching:—On several occasions I have hatched out Bloodsuckers' eggs with varying degrees of success. My failures I attribute to inadequate methods. After several experiments I have found the following method most efficient also for snake eggs and on the whole have had almost cent per cent. success with it. It is this:—Place the eggs on a bed of damp (not wet) earth in a Petric dish; place the dish in an ordinary glass desiccator, the bottom of which is half-filled with water. Now put on the lid leaving it slightly open to allow air to circulate. Leave the whole in a convenient place till hatching is complete. This method prevents the eggs from drying—the chief cause of failures—they remain perfectly terse. It is also a convenient

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way as the eggs can be watched without distributing them too much.

Newly hatched young:—As soon as the shell is split and the hatchling is able to put its head out it does so. In this position it remains for a considerable time. It will now and then open its eyes and shut them again as though in sleep. From time to time it wriggles in the shell and the surplus embryonic fluid oozes out. Eventually it leaves the shell with the remains of the 'naval cord' still adhering. This is soon rubbed of. On emergence the little lizards are extremely active. A day before the lizard was due I opened an egg and measured it. This specimen measured 72 mm. Another after hatching measured 76 mm. Of course, these measurements are only given to show the approximate size of the young after hatching and probably the young from differently sized eggs would also vary a bit. At birth, the young lizards are yellow in tone with a metallic lustre and with two longitudinal stripes on either side of the crest and with several darker transverse markings. The young maintain these patterns for a considerable period, but the intensity and brilliancy of the markings depend greatly on environment.

Food:—The Bloodsucker is mainly insectivorous, but to this it adds birds' eggs and nestlings during the seasons. For this statement I have had ample evidence. In vol. xxxix, p. 640, Mr. C. H. Biddulph records a Bloodsucker catching a lark. Small lizards and small frogs that it can overpower are also eaten. Earthworms and tiny crabs are also taken.

Enemies:—The enemy cycle of the Bloodsucker is a wide one. Among the mammals cats, even domestic cats, often eat them. Mungooses prey largely on these lizards when the latter are on the ground or in small bushes. I have frequently seen the Common Mungoose (*Herpestes mungo*) catching them. Among the birds, the Bloodsucker has a host of enemies. The smaller birds of prey feed largely on them. Crows, egrets and herons, even the domestic fowls feed on them. The Bull-frog will take those that it can overpower. Snakes, particularly arboreal species, feed largely on these lizards.

Ants and earthworms destroy the eggs.

Parasites:—I have occasionally found ticks between the scales, but perhaps the most harmful parasites are internal. On dissection I have frequently taken Nematodes between 2-3 inches long from the stomach and smaller species from the rectum. In some instances these have been many in a single individual. From the lungs I have taken what appeared to be the maggots of flies. In one case I found one such larva in each lung. The maggots were large measuring about an inch and a quarter when dead. The nasal passage is often choked by the presence of fly larvæ.

Agricultural:—From an agricultural aspect, the Bloodsucker is a most useful animal, destroying numerous insect pests.

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REVIEW

I. SOME BEAUTIFUL INDIAN TREES, By The Late Rev. E. Blatter, S.J., Ph.D., F.L.S. and Walter S. Millard. Illustrated with 31 coloured and 37 black and white plates. Price Rs. 15. Published by The Bombay Natural History Society, 6, Apollo Street, Bombay.

A series of articles on Beautiful Flowering Trees which appeared originally in the *Journal* of the Bombay Natural History Society elicited at the time a more than ordinary interest in a large circle of appreciative readers. Not all of these were botanists and men of science; many, in fact most of them, were just ordinary people fond of gardening, perhaps, and with an eye for nature's many-coloured beflowered garb, and for these the articles had a special appeal inasmuch as they were enabled to know more intimately what they already admired, without being first submerged in a sea of scientific technicalities and impressively unintelligible names.

These articles, revised and partly rewritten are now published in book form under the title of *Some Beautiful Indian Trees*. This title calls for a word of explanation. The beautiful trees which adorn so many of the pages in this book are not all of them indigenous to India, in fact the majority of them have been introduced at one time or another from outside, but, whatever their origin, they are now commonly to be found in this country and they share one common characteristic: they are every one of them beautiful. Nor are their names insignificant: consider the Noble Amherstia, the Gul Mohur, the Flame of the Forest, the Rusty Shield Bearer, the Scarlet Bell Tree: what a wealth of colour and variety these names conjure up! Then there are others less 'flamboyant', suggestive rather of a *frail* æsthetic beauty: the Sacred Barna, the Lignum Vitae, the Sacred Asoka Tree which, according to Hindu mythology, is the symbol of love and dedicated to Karma.

The book contains 31 coloured illustrations and 37 black and white plates, each one a tribute to the painstaking efforts of artists and photographers alike. The coloured plates are all reproductions from hand-painted water colours and are remarkable alike for beauty of colouring and the minute attention to detail which is evident throughout. Here you will find the complete life-story of 39 beautiful trees told in plain, simple language with hints for the gardener and particulars of each tree's domestic uses, medicinal properties, and sacred significance. The average reader will find here more information, and that more easily digestible, than he would probably expect, and one cannot but admire the team work which has made the publication of this attractive book possible. Artists, scientists and others have given of their time and knowledge unstintingly, and it is gratifying to know that all but two of them have lived to see the task completed. Of these two, Sister Mary Chiona was responsible for ten of the original water colours, and Fr. Blatter with his profound knowledge of Botany made this book itself possible. In acknowledgment of their unselfish collaboration the book is, very fittingly, dedicated to them.

J. F. C.

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MISCELLANEOUS NOTES

I.—SMOKING A PANTHER TO DEATH.

I was interested to read in the last issue of the *Journal* the account of the smoking of a tiger to death. I had a similar experience, years ago, in one of my Shikar trips when a panther was unwittingly smoked to death.

The year and the date I cannot exactly remember and at present I cannot refer to my diaries; but it was about 37 years ago when I was staying at the hill fort of Sinhgar near Poona for the summer. There are in the jungle near about small panthers and other wild animals. One day, when we were out shooting, a small panther was observed in the beat and was tracked by its pug-marks to a small cave. In order to dislodge him, we smoked the cave at one end, the guns being posted at the other. As the panther did not come out, it was thought that the animal had lodged itself near the opposite opening of the tunnel, which also was smoked. After a little while a gasping sound was heard from within. The expert tracker with us said that it was the death-gasp of the panther. We wanted to go in to see what had happened, but the son of the shikari, who was watching the proceedings from the top of a tree became suddenly possessed by the local deity and ordered the people to desist from entering the cave until the next morning. It was sound practical advice which we obeyed. No watch was kept at the cave. We did not believe the story of the shikari, but next day, to our surprise, the villagers, in the company of one of the guns, went into the cave and dragged out the carcase which they brought to the fort where I was staying then. If I remember rightly the above incident was reported in the local Poona English papers of the day.

CAMP MADHAVGIRI,

AJRA, CHIEF OF ICHALKARANJI.

May 11, 1937.

II.—THE SIZE OF THE JUNGLE CAT (*FELIS CHAUS AFFINIS*).

In the Society's *Journal*, vol. xxxvii, No. 4, under the heading of 'The Wild Animals of the Indian Empire', I observe that the Jungle Cat is recorded as being 'Head and body about 2 ft. in length; tail 9 in.' During the last few months I have shot three of these cats near my bungalow, where they have been in the

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habit of raiding my ducks and pheasants. I give the measurements herewith:

Feb. 18th.	Male.	Head and body 2 ft. 6 in.	Tail 10 in.
May 26th.	Male.	Head and body 2 ft. 1¾ in.	Tail 10½ in.
June 10th.	Male.	Head and body 2 ft. 6¼ in.	Tail 11 in.

I would be very interested to hear if the size of these cats is at all unusual, and if the last mentioned one is anything approaching

The Jungle Cat (*Felis chaus affinis*).

a record. The measurements were taken as soon as the animals were shot, and from peg to peg.

I do not think the Jungle Cat is particularly common in Assam, but there are quite a number about in this district at present. Several others I have shot at and missed, mostly at dusk or after dark; and twice I have had kittens brought in from the jungle about three weeks old, at the end of January and beginning of February.

BADLIPAR, P. O.,
ASSAM,
July 11, 1937.

E. P. GEE.

III.—THE ALLEGED WILD DOG OF MT. POPA, BURMA.

Early in 1936 in a paper on the Asiatic Wild Dogs (*Proc. Zool. Soc.*, 1936, p. 33), I incidentally remarked that 'curiously enough next to nothing is known of the character of the Dholes

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of Burma, where the collectors for the Mammal Survey . . . failed to secure a single specimen'. This statement, based on the absence of specimens in the British Museum, produced a letter from Mr. Shortridge to Mr. Millard saying that he secured one on Mt. Popa and asking what had become of it. True enough the specimen was entered by Wroughton as *Cuon rutilans*, with the collector's number attached, in the MS. list of the collection from Mt. Popa, and cited under that name with Shortridge's note about it, in Wroughton's report (*J.B.N.H.S.*, vol. xxiii, p. 471, 1915). In this note the animal was described as an adult ♀, with only 10 mammae and weighing 19 lbs., which was run down and killed by a village dog, a fate which Shortridge surmised would never befall its larger ally, the typical Wild Dog of India.

I was particularly anxious to see this specimen, not only on account of the small number of mammae which in the Wild Dog vary from 6 to 8 pairs, but also to secure the flesh measurements of what was evidently from its weight an unusually small Wild Dog, which might prove to be a distinguishable form restricted to Mt. Popa, a volcano rising from a dry area unsuitable as a habitat for the ordinary Wild Dog. But the specimen could nowhere be found either in the British or Bombay Museums. But the mystery of its disappearance is now solved. The skull, with the locality and number attached, turned up in the British Museum. It is the skull of an old, small domestic dog, with a short muzzle and high crown, measuring only just over 6 inches in length, about as long as a Jackal's, much shorter than the skull of the Wild Dog and quite unlike it in all the characters which distinguish the skulls of *Cuon* and *Canis*. It had been put aside, unregistered, as of no zoological interest. Possibly Oldfield Thomas detected the error in its identification after the issue of Wroughton's report, but neither he nor Wroughton published the correction of it that was called for. In doing this I should like to add that Shortridge and Wroughton are by no means the first zoologists who have failed to distinguish 'dingo-like', feral dogs (*Canis*) from the oriental Wild Dog (*Cuon*).

ZOOLOGICAL DEPARTMENT,
BRITISH MUSEUM.

R. I. POCOCK.

IV.—CURIOUS BEHAVIOUR OF BISON (*BIBOS GAURUS* H. SM.).

It was the month of May in the Kanara Forests of the Bombay Presidency.

I had started at dawn to try and procure a good bull bison. Soon after arrival in the forest my 'shikari' and myself came on a shootable head which I shot at 5.40 a.m.

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I continued my walk in order to get to know the country and look for other spoor such as tiger, panther, bison, or elephant. Several bison tracks had been seen and the fresh pug marks of a tiger. I decided to return home at about 7.30 a.m., and was walking down the track, on which the tiger pug marks were, towards the main motor road about half a mile away, when I heard a barking-deer bark in a frightened way. Shortly afterwards I heard a tiger roar exactly in the same way he does when turned by a stop in a beat—it sounded deeper although it was some distance away from me. Thinking that he may have been disturbed off a kill I pushed through some thick Bamboo forest to have a look and see. On arriving at a teak and bamboo plantation from where the noise seemed to have come I turned up a little incline along a ride at the edge of the plantation. I had not gone 30 yards when coming down the incline at right angles to me I saw a tiger moving at a fast walk. When twenty yards away he stopped and I bowled him over. Within a few seconds a tigress appeared over the brow of the hill and came down at an amble stopping exactly where the tiger had stopped and looked at her mate making a noise like a cat mewing. She dropped to my second shot. I had to go up and give the tiger another shot as he was still kicking but could not move. The sounds of the third shot had scarcely died away when I heard a noise in the plantation and shortly afterwards a young bull bison walked out on to the ride quite near the tigress and started sniffing the carcase. Being afraid that he might damage the skin with his horns and hooves I shook a young teak sapling to frighten him away. He looked up, took not the slightest notice and went on sniffing. A little later another bison came and joined the first and only moved off when the 'shikari' and myself clapped and shouted at them—even then they only walked very slowly into the thick forest. I was unable to find any signs of a fight between the tiger and bison or of the tigers having killed. The two bisons snorted at me again when I was having a search for evidence of this strange occurrence. I would like to know if anybody can explain the reason of the bisons' attitude. Usually they are very shy animals—the breaking of a twig or a whiff of human scent send them charging away—but on this occasion after three shots from a 450 H.V. rifle a bison walks out and smells the carcase of a dead tiger. It sounds incredible.

Mr. Hiley the Chief Conservator of Forests, Bombay Presidency, informs me that he has never heard of or seen the like before in all his service in India.

The bison were so close that I could see they had not been mauled or attacked by the tigers and no kill was found.

GOVERNMENT HOUSE,
BOMBAY,
May 31, 1937.

C. G. TOOGOOD.

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V.—ABNORMAL ELEPHANT TUSKS (*ELEPHAS MAXIMUS*).

(*With a plate*).

I send you two photographs of a solitary elephant carrying tusks of a most unusual shape and symmetry. The awkward position in which he wore his tusks is really responsible for his death. This elephant had been doing extensive damage to crops in the Borelli River area, in the Tezpur district of Assam. I was able to follow up that night's tracks and after about 6 miles came upon him, wallowing in a small *bheel* 200 yards ahead of where I stood. As I was deliberating the best method of approaching him, he winded us and made off full tilt. I had a very good Miri tracker with me, and after pushing on his trail for an hour or so I thought it was going to be an all-day job, when the tusker foolishly changed his direction and plunged into 'Geruka' jungle. We listened carefully and could then hear him breaking through about a quarter of a mile ahead. We left his tracks and ran as fast as was possible in soft mud along the edge of the Geruka patch to head him off, and we arrived at the other end just as the tusker was emerging into the tree jungle at the spot we were standing. He came out directly facing us, and one barrel from my .470 fetched his brain. Had this elephant kept to tree jungle he would probably have put many miles between us before pulling up.

I shall be interested to hear if any other of your readers has seen an Indian elephant with tusks similarly pointing to the heavens.

THE KACHARI GAON TEA CO., LTD.,
TEZPUR, ASSAM. G. D. L. MILLAR.

August 14, 1937.

VI.—ABNORMAL HORN GROWTH IN THE MUNTJAC (*MUNTIACUS VAGINALIS*).

(*With a photo*).

I enclose a photograph of a Kakur head with two coronets on one pedicle. The lower part of the horn is smooth and nearly black

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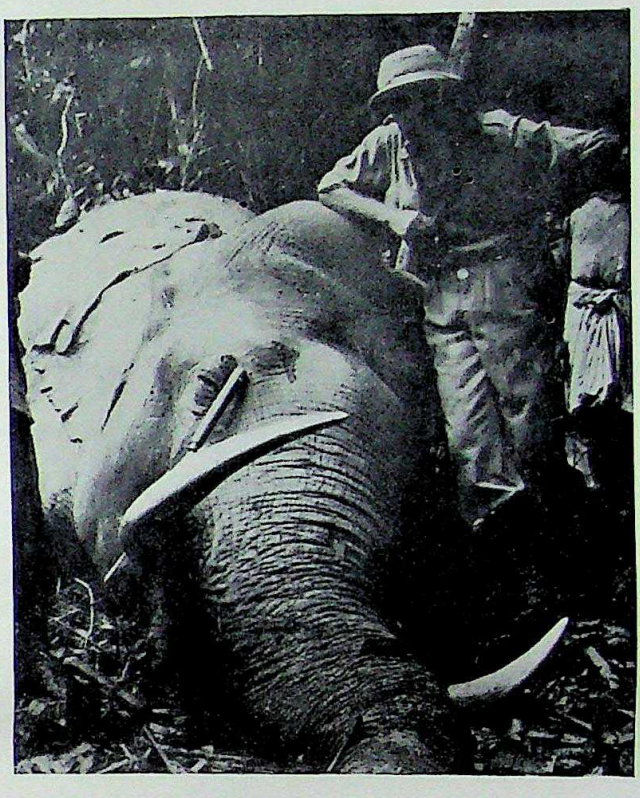

Photo by *G. D. L. Millar.*

Abnormal Elephant Tusks.

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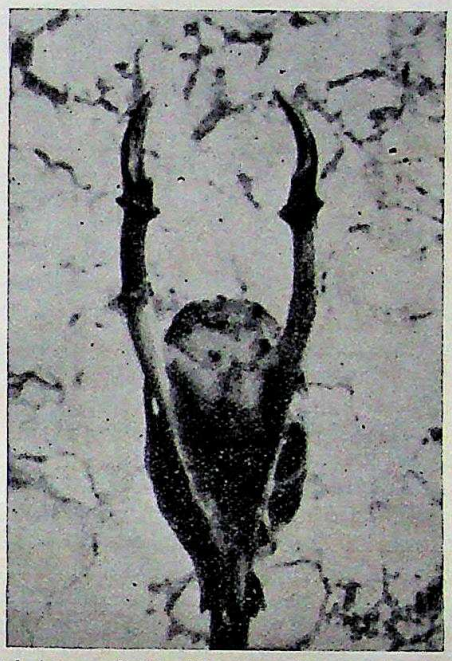

Abnormal horn of the Muntjac (*Muntiacus vaginalis*).

with no covering of skin and as such distinct from the pedicle. The animal had a very dark hide.

DHALIPUR P. O., HERBERTPUR,
DISTRICT DEHRA-DUN, U.P., F. H. PEPPE.
May 21, 1937.

VII.—THE USE OF FIREWORK OR ROCKET CARTRIDGES IN THE PROTECTION OF CROPS.

I have recently experimented with excellent results on the use of 12-bore firework or rocket cartridges, in bolting elephants out of ryots' crops; the most suitable cartridge being the type bursting with a brilliant flash and loud report at the end of flight. The elephants stampede out in panic, and are chary of returning to the same field that night. The cartridges are at present expensive, about Rs. 17 per 100, German made; with an increased demand the makers should be able to produce them at half the price and of the kind required, instead of an assortment of types in packets as now sold. I venture to think that this may go a long way to solving the vexed problem of the issue of gun licenses for crop-protection, the majority of which now cover weapons used chiefly for poaching. If the license prohibited the holder from purchasing cartridges other than firework or rocket dealers would not be able to supply anything else. The effect on crop-raiding animals other than elephants would I am sure be the same. The

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gun is aimed directly at, or a little above, the crop-raider, according to distance.

HONNAMETTI ESTATE,
ATTIKAN P.O., R. C. MORRIS.

December 3, 1936.

VIII.—SOME NOTES ON THE FAUNA OF MALAYA.

In my article 'Early Days in Malaya' (*J.B.N.H.S.*, xxxviii, 241) I mentioned that certain beasts and birds of India did not exist in that country, and among these are the hyæna, the jackal, the vulture, the common kite, and the grey-necked crow. For the greater part the fauna of the two countries is the same, but it is noticed that in some there is a slight difference in colouring, and that in others the habits are not alike. Environment is responsible for this, and while a darker or a lighter shade in colour is due to habitat, the greater shyness noticeable may be accounted for by the fact that it is only in recent years that certain denizens of the forest have become acquainted with Man.

A few notes bearing on this might be of interest, and at the same time I take the opportunity to record a few incidents omitted previously, and to make observation as to the seeming paucity of wild life in those jungles, which impression is only corrected by a visit to one of the museums. The several museums in Malaya contain stuffed specimens of a great variety of birds which I have never seen in their wild state. I lived in the jungles for many years, and it was not that I was ignorant about the birds being there, or that I did not look for them. It just happened that they would not be seen. We know that peafowl and the Argus pheasant are there, and in some districts I was in they were all around me. I heard them, and looked for them, but never saw one. It is not difficult to understand, that, in forests carrying heavy undergrowth, walking up ground birds is next to impossible, and as any attempt to do so is noticed by them the chances of their coming back to oblige is very remote. It is possible that certain of the wild life which I have stated does not exist there, is known and reported on by naturalists, and if this is the case it gives proof to my contention that these birds and beasts are more shy of man than they are here.

Common birds like shrikes, the weaver birds, the orioles, wagtails, the woodpeckers, the kingfishers, the green barbets, hoopoes, nightjars, and various pigeons and doves are in some instances Malayan forms of those occurring in India, but the jungle cock is not the jungle cock of the Nilgiris, the robin is not the same, and the buzzard appears to live differently. Mynas in Malaya are essentially jungle birds and are never seen near human habitations. Among the wild beasts, the tiger has a

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liking for dogs, and this I believe is not the case in India, and I give instances of the carnivorous tendencies of the common wild pig of the country. I include a few birds which perhaps do not call for comparison, but notes on which may be of interest.

Pea-fowl and Argus Pheasant.

The wild pea-fowl of South India is a shy bird, but it comes out to feed on crops, and can be seen in the jungle. I doubt if any sportsman in Malaya has ever shot one, and I have not met any one who has even seen one. One does not hear of them doing damage to crops, or that they ever come near villages, and old Malays will tell you that they can only be obtained by traps. Like the pea-fowl the Argus pheasant is very seldom seen, and I know of none having been shot. I lived for two years at a place called Kendong on the borders of Malacca, where, judging by the calls I heard in all directions every morning, they must have been fairly numerous, and yet I never set eyes on one. I endeavoured on many occasions with much patient stalking to try and bag one, but without success. I sometimes got so near that the piercing call 'pee-ow' was most deafening, but the moment I bobbed up the bird disappeared. It was on one of these occasions that I saw a black panther tracking the same bird, and it speaks well for my stalking that I saw the beast before he saw me, but for a second only, and in that second both he and the pheasant were gone. I have heard tell of the cock bird's courtship dance and the circle on the ground he prepares for this, but it has not been my good fortune ever to see one of these grounds. I imagine the only means of getting a pheasant would be to sit up all night in a tree and wait for the performance next morning, but it would have to be a seat in a forked branch, as I am sure the erecting of a machan would drive the bird away into the next county.

Sambhar.

The Malayan sambhar is very destructive to young rubber trees, and before proper methods of fencing were adopted many thousands of pounds worth of damage was done by this beast. Strange to say he seemed to have no liking for seedlings, or for plants up to two and three years old, and since for this period no fencing was found to be necessary, planters were lulled into a sense of security from loss by damage from animals, and it was quite suddenly that many estates woke up to the fact that the sambhar had discovered that the bark of four- and five-year old trees was just what he wanted. Rubber planting was undertaken on a large scale from about the year 1906, and at the end of 1910, when rubber was selling at twelve shillings the pound, anything from five to ten millions of trees had reached the age as food for deer. Damage was done on practically all the estates I knew in Negri Sembilan and Johore, and also in Malacca, and at a low estimate I would put the number of trees destroyed, in the first few years following on 1910, at 50,000; and the value of a tree at that time was £2,

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Planters and Directors of Rubber Companies who might chance on these notes would possibly think this a much exaggerated statement, but thirty years is a long stretch and memories are short lived, and I would ask them to refer back to old reports, where they might read that in a certain field twenty or thirty trees were wiped out in a night, or that during the month a hundred trees were lost. These figures when spread over a period of years, and occurring on not one but several estates, might easily mount up to considerably more than the figure of fifty thousand which I give, and which is only one per cent of five million trees. Many thousands of pounds were spent on fences, and once again a lesson was taught. Barbed wire fences erected to a height of five feet appeared to be satisfactory for a few weeks or perhaps a few months. The deer were suspicious of the fence but they soon found out that they could jump it. Fences bordered the jungle and there was no space for a running jump and this meant they could leap over from a standing position. Higher fences were required and the remedy was to interlace the wire with saplings to a height of eight to ten feet, and this meant more expense. It was noticed that when the tapping of trees was commenced no new damage was done. It was not that the bark had become harder and grown unsuited to the deer's taste, since un-tapped trees in the same field were still subject to attack. The reason for this seems unexplainable.

I have never attempted to shoot a stag on the Nilgiris, but for the fun of the game I have stalked and got within range on a number of occasions. If driving is done, shooting is still more easy, as on these hills the stag breaks cover to cross open country, and as the woods are small a close shot can be had. Conditions are very diffierent in Malaya, and a sportsman who bags a sambhar is a man who accomplishes something really difficult. Stalking is impossible, and driving has to be done, but before a drive is organized a tracker is sent in advance to locate the stag and then to return and report. He knows to within fifty yards or so where the stag is lying up, and by no means can you expect it to break in country affording a clear view. The shooting has to be done in the jungle, and a shot at a running stag under these conditions is not easy. A clever shikari will drive him to the most open space available, but this might only mean that it is not so dense as the area from which he breaks, and you may be sure when he does reach this spot he bounds off faster than ever and makes the proposition an exceedingly difficult one for the man behind the gun. It is not always that the stag is seen, and my experience is that he is very seldom seen. One animal bagged over a series of a dozen shoots is a fair average.

I should like to put in a word here about the Malay as a tracker. I am told there are no better trackers than the jungle people of India, and while not wishing to make any comparison, I must say this for the Malay that he is clever at the game, is reliable and keen, and possesses the useful trait of truthfulness, and in this last respect can give points to the average professional shikari of the Nilgiris.

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On the Nilgiris I have more than once been asked to believe that the marks made in the sand by a man who had run ahead were the pug marks of a panther which had only just moved off, and once I was shewn a cow which had died a natural death, and which after death had been scratched about with a knife, and was told that a panther had done this. A Malay would never make himself out to be so great a fool, and he would be ashamed to tell such lies.

Wild Cats and Civets.

There is a large variety of cats in the Malayan jungles, two of which I have seen on the Nilgiris, viz. a large jungle cat and a smaller spotted cat. On these hills I have also seen a small species of civet. In Malaya we have this small civet, and a very large one which measures four feet and over from nose to tail.[1] I did not take accurate measurements of one that I shot, but I estimated its length at fully fifty inches, and its weight at twenty-five pounds. It was in tall grass, and when I fired I thought I had brought down a panther. There are two cats which are uncommon there, and which perhaps might not be generally known in this country. Description must necessarily be difficult to one who has not taken up the study of Natural History, and I hope my endeavour at doing so will enable naturalists to identify them. The first to mention is an animal as big as the jungle cat, but of different colour and markings, with a long tail and not the stumpy tail of the other. Its colour can be best described as dark mahogany, and it has a black tip to its tail. It is one of the most handsome cats I have seen, and having seen and secured only one, I regret the skin is not with me now. It was in my bungalow for many years, and as it may possibly be still there I have written about it. The other cat is yellow, or of a bright gold colour.[2] It is long in the body and has a long tail, but is considerably smaller than the big civet mentioned. I saw a pair walk across a stream over a fallen tree, and with the sun shining on them they looked extremely pretty. It will be interesting to know if these two cats are found in India. I must recount here an incident which, although it might sound like a Fairy Tale, is given exactly as it happened. My dog 'Bob' had killed quite a number of small civets which came after the fruit we had growing round about the house. I used to let him out early in the mornings, and very often he caught and killed one of these animals which was late in getting back to the jungle. One morning he did not rush out as he usually did, and in fact would not move out of the house. He did not appear to be sick, but no enticement on my part would induce him to come

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[1] The civets referred to are probably the Malay form of the Small Indian Civet (*V. indica klossi*) while the larger civet is probably the Burmese Civet (*M. megaspila*).—Eds.

[2] This may have been a small specimen of the Golden Cat (*P. temmincki*). —Eds.

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beyond the doorway, where he stood and sniffed the air in a nervous way. I thought he must have sensed a tiger so I took him inside to wait till the day grew brighter. An hour or so after this my car-driver, who knew about Bob's skill as a killer, casually mentioned that it was unfortunate the dog had not been let out at his usual early hour as he might have killed several civets that day. He went on to say that he had seen about forty of them moving about in a body till sunrise. The man was very definite about this, and although, after much questioning he reduced the number from forty to twenty, I felt there was no doubt but that the civets were there in force and that Bob knew this and was afraid of their numbers, or even had the idea that they were there to do him in. There is the possibility that there was a tiger about as well and that the civets were hanging about till it had gone.

I am reminded of something amusing that happened far up a river called the Palong. A naval officer friend was in camp with me, and in one of the villages on the river we saw two cats of a bright pink colour. Stewart, my camp mate, wanted to buy them and in his best Malay offered a fairly big price, but the honest old people whom he spoke to, laughed and told him that the cats were white ones, and that they had been dyed.

Macacs.

There is a monkey in Malaya which Malays call 'Broh', and which looks like a small edition of the South African baboon. In its jungle haunts it is a fearsome beast and sometimes attacks men, but when caught young is easily tamed and is made use of to gather coconuts.

There is usually one 'Broh' in each village which has been taught to climb the coconut palm and drop the nuts which his keeper makes him to distinguish by jerking his leading rope in a peculiar way.

About twenty-five years ago one of these animals, a large male, took up his quarters in a small area of reserved forest which was practically in the heart of the town of Kuala Lumpur. He was a danger to people, and bit several before he was rounded up and killed.

Wild Pig.

Like the rest of his kind, the wild pig of Malaya is a glutton. It is known that he eats carrion, and in the pioneer days in Perak, before the Authorities had had time to lay down Burial Laws, or perhaps before they had the means to enforce such laws, certain nationalities, careless in this respect, dug shallow graves from which pigs had no trouble to exhume the dead bodies. Cases were being constantly reported by construction engineers. As a carnivorous animal he is not so well known, but when I mentioned the following incident to a District Officer, a Mr. Fleming, he told me he had on two or three occasions seen a

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wild boar attack and eat sheep and goats. The incident I record is rather different, and is astonishing from the point of view that the happening was so sudden and so unexpected on the part of the victims. I met a Mr. Rae out for a walk with his two terriers, and presently ahead of us we spied a herd of pig. The dogs saw them at the same time and immediately gave chase. Warning Mr. Rae that his dogs would be hurt unless they were called off, I followed him as he ran ahead to do this. We were in a railway cutting, and by the time we had got round a curve the pig had made their get away into the jungle and there was no sign of the dogs. There were also no sounds to be heard, and we were at a loss to know where to search, but while discussing our next move I happened to pick up a dog's collar, and in another minute or two we discovered one other, both of which were recognized as belonging to the two dogs. The collars were found in the open but there were no bones about, and the presumption is that the dogs were surrounded and completely devoured. I hope, if Mr. Rae should happen to come across this note, he will kindly write to confirm the incident.

COONOOR, S. INDIA,
October 2, 1935. H. E. BURGESS.

IX.—SOME INTERESTING RECORDS OF BIRDS IN THE PUNJAB.

During the past three years my *Shikari* and I between us have secured specimens of the following birds in the South-East of the Punjab. These have been examined by Mr. Hugh Whistler, who has kindly furnished me with the particulars of previous records given below:—

1. **Metopidius indicus** (Lath.). Bronze-winged Jacana.

A juvenile ♂ obtained at Karnal on 5th September, 1934. There appears to be no previous Punjab record.

2. **Emberiza aureola** (Pall.). Yellow-breasted Bunting.

♀ shot at Jagadri in the Ambala District on 5th March, 1935. An adult ♂ was obtained in the same locailty by A. E. Jones on 22nd February, 1920 (*J.B.N.H.S.*, xxxi, 1003).

3. **Eurystomus orientalis** (L.). Broad-billed Roller.

♂ shot in the *sal* forest at Kalesar in the Ambala District on 19th May, 1935. No previous Punjab record has been traced.

4. **Alcemerops athertoni** (Jard. & Selby). Blue-bearded Bee-eater.

♀ obtained from a small flock in the Kalesar forest on 23rd February, 1936. Stewart (*Zoologist*, 1886) records one shot at Koteghar on October 20th.

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5. **Chrysocolaptes guttacristatus sultaneus** (Hodgs.). Hodgson's Golden-backed Woodpecker.

♀ obtained on 24th and ♂ on 26th February, 1936 in the Kalesar forest. This appears to be the first record for the Punjab.

6. **Pericrocotus speciosus speciosus** (Lath.). Indian Scarlet Minivet.

A pair obtained from a mixed flock of this and *P. brevirostris* in the Kalesar forest on 3rd December, 1936. 'I have only once procured a pair north of Bilaspur; it does not seem to be found in the interior of the hills' (Stoliczka, *J.A.S.B.*, 1868). A ♀ was obtained at Garampani and ♂ ♀ at Pulga in the Kulu Sub-division of the Kangra District in May (*Mission Babault*, p. 158).

7. **Hydrocissa malabarica malabarica** Gmelin. Large Indian Pied Hornbill.

♀ shot in the Kalesar forest on 2nd December, 1936. 'In my father's game-book there is a note about "black and white Hornbills" found at Morni on 28th November, 1886. This can only refer to this species, which occurs in Dr. Scott's list under the locality Siwaliks' (Whistler, *J.B.N.H.S.*, xxvi, 176).

RAWALPINDI,
PUNJAB,
July 15, 1937.

H. W. WAITE, M.B.O.U.
Indian Police.

X.—MIGRATORY MOVEMENTS OF THREE WELL KNOWN BIRDS IN THE TANJORE AND SOUTH ARCOT DISTRICTS.

The three birds under reference are 'The Indian Paradise Flycatcher', 'The Rosy Pastor' and 'The Indian Oriole'.

Two of these birds are local migrants, while the Rosy Pastor is a true migrant in the Tanjore and South Arcot Districts.

Observations have been recorded in the case of the Paradise Flycatcher during four years and in the case of the other two birds for three years, the results showing that the Paradise Flycatcher is found during the period October to April, being absent for approximately five months in the year. The Rosy Pastor is found during the same period, but as the two departure dates are 13-4-35 and 19-2-36 it may be assumed that they stayed longer than usual in 1935 or left earlier than usual in 1936.

The Indian Oriole is also found during the period October to April, the date 22-5-36 is unusually late and is the last date on which a female was seen in the South Arcot District. All other orioles had left before this date in the Tanjore District.

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For easy reference a table of actual departure and arrival dates for the above birds is furnished. The dates represent when the first and last bird of each species was seen by me.

TABLE OF DEPARTURE AND ARRIVAL DATES.

Species.	1933		1934		1935		1936	
	Departure	Arrival	Departure	Arrival	Departure	Arrival	Departure	Arrival
The Indian Paradise Flycatcher. *Tchitrea paradisi paradisi* ...	.....	3-10-33	14- 4-34	14-10-34	25-3-35	3-11-35	23- 4-36	18- 9-36
The Rosy Pastor. *Pastor roseus*	.....	.....	.....	3-10-34	13-4-35	13-11-35	19- 2-36	2-12-36
The Indian Oriole. *Oriolus oriolus kundoo*	.....	.....	.....	29-10-34	23-4-35	4-11-35	22- 5 36	6-10-36

TANJORE,
February 9, 1937.

C. H. BIDDULPH.

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XI.—CURIOUS BEHAVIOUR OF THE JUNGLE CROW (*CORVUS MACRORHYNCHUS*) AND THE WHITE-BACKED VULTURE (*GYPS BENGALENSIS*).

On the 30th May (1937) I came upon the remnants of a White-backed Vulture's (*G. bengalensis*) nest with a fully fledged young one in it. During the absence of the parent the young bird perched on neighbouring branches, made short flights and then returned to its perch near the nest. As soon as the parent bird arrived the young would flop into its nest, or rather what was left of it, and behave like a true nestling, flapping its wings and making all possible noises and movements in pleading to be fed. The adult bird always alighted near the nest. Its arrival was the signal for a pair of enterprising Jungle Crows immediately to be in attendance, to snatch the crumbs that fell, as I then thought. But the crows behaved quite differently—theirs was not the role of Lazarus. As soon as the adult vulture regurgitated some food for her young the crows would either sit on the young vulture's back or fly to its mouth and try to snatch a morsel. The old bird attempted from time to time to drive the crows away but they moved out of reach to return again the next instant.

When the adult vulture departed the crows left the nest and the young bird again took up its perch on its favourite branch; but on the return of the parent the same manœuvres were repeated.

BOMBAY NATURAL HISTORY SOCIETY,

May 31, 1937.

BOMBAY. C. McCANN.

XII.—THE DISTRIBUTION OF THE WHITE-EARED BULBUL [*MOLPASTES LEUCOGENYS LEUCOTIS* (GOULD)] IN THE SWAMPS NEAR THE VAITARNA RIVER.

Messrs. Sālim Ali and Humayun Abdulali in their paper on 'The Birds of Bombay and Salsette' (*J.B.N.H.S.*, xxxix, p. 101) with reference to the status of the White-eared Bulbul (*Molpastes leucogenys leucotis*) suggest that the occurrence of this bird, within the area dealt with in their paper, is perhaps due to escaped birds breeding within the area, or to an immigration from further north. If anything, the second suggestion appears to be more likely. On the 20th March this year (1937) while walking along the swamps between Virar and the Vaitarna River, I observed the bird to be fairly plentiful. It 'associated' with *M. cafer cafer* and *Otocompsa f. fusciaudata* and roosted in the swamps. The bird appeared to be definitely established in the locality. Later, I have observed the bird in the swamps at Ghorbunder, Salsette Island.

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There seems to be little doubt, as the authors suggest, that this bird appears to be associated with the distribution of *Salvadora persica*.

BOMBAY NATURAL HISTORY SOCIETY,
BOMBAY.
May 27, 1937.

C. McCANN.

XIII.—THE SOUTHERN INDIAN ROLLER OR BLUE JAY [*CORACIAS BENGHALENSIS INDICA* (LINN.)] KILLING A SMALL SNAKE.

Baker and Inglis in *The Birds of Southern India* refer to the Roller killing and eating mice and small reptiles and in the *Journal* of the Society, No. xxxix, p. 179 there is an interesting note regarding this bird killing and eating a large scorpion.

While out on the 3rd December this year I noticed a Roller suddenly fly up from an aloe hedge with a small live snake 8 or 9 inches in length in its beak. The snake was held just behind the head and was twisting about trying to get a grip on some portion of the bird. The Roller was uttering its harsh cry all the while and although the snake's struggles almost caused it to release its hold it eventually made for a palmyrah palm where it is presumed it killed the snake.

I have seen a Crow-Pheasant sitting on a rail along the railway track engaged in killing a large black scorpion and it is presumed it was going to eat it as I did not see the whole operation due to the bird becoming alarmed and flying away with the scorpion in its beak.

TANJORE,
February 9, 1937.

C. H. BIDDULPH.

XIV. BREEDING OF THE LITTLE INDIAN NIGHTJAR (*CAPRIMULGUS ASIATICUS ASIATICUS*) IN THE CHINGLEPUT DISTRICT.

(*With a plate*).

I see in the report of the 'Vernay Ornithological Survey of the Eastern Ghats' (vol. xxxviii, No. 1, August 1935, p. 39) that 'nothing has been recorded about the breeding season' of the Little Indian Nightjar, *Caprimulgus asiaticus asiaticus* in the Presidency of Madras. It may therefore be of interest to record that on July 11th, 1937, my husband and I disturbed a nightjar in an exposed spot in the scrub jungle near the foot of the Tambaram Hills (100-200 ft.), and, after some search, discovered a single egg, on

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the ground among the stones and rocks. It was brownish-pink much mottled with darker red, and somewhat lighter than the surrounding stones. We were not able to return to this place until August 1st; we then found that the egg had disappeared from the spot where we had seen it on July 11th, but after careful search we found the nightjar some yards lower down the hillside, crouched low with its chin on the rump of the chick. Not even when we bent over them to examine them did either move; in going up the hill to the place where we had previously seen the egg, we must almost have trodden on them, but not the slightest movement had attracted our attention.

On August 5th we went again, hoping to photograph the two, but they had again moved, and while we were searching among the stones, from somewhere close behind us the nightjar flew up and past us, followed immediately by the young one; they took shelter among the rocks and thorny bushes of the hillside, where we could not find them.

We believe this nightjar to be *Caprimulgus asiaticus asiaticus;* the bird with the 'tuk tuk tuk tukeroo' call is abundant in the scrub jungle of this district (16 miles S.W. of Madras City) as in our garden, and has been seen and heard by us in every month of the year, during the five years in which we have been resident here; and as we not infrequently flush nightjars under the bushes in the day time, we have been able to compare them with the descriptions in *Birds of Southern India* by Baker and Inglis, and in Whistler, and there seems little doubt that these birds are *C. a. asiaticus*.

The moving of the nesting position has also been observed by us in what we believe to be *C. indicus indicus*. On April 28th 1935, we discovered a nightjar and two eggs among the rocks and stones on a hillside on the Ootacamund Downs (about 8,000 ft.); when revisiting the place a few days later, we found that the eggs had been moved several feet, and on May 11th, we found the young birds in still another spot. An interesting feature was the difference in the behaviour of the parent bird before and after the hatching of the young. Each time when disturbed by us when sitting on the eggs, the bird flew straight up and swiftly away to a considerable distance; but after the chicks were hatched it flew slowly along the ground, flapping and dragging a wing as though wounded, and settled at only a short distance from its young.

We found a nightjar and two young on the Bikkepatti Ridge (about 6,500 ft.) on the N.W. edge of the Nilgiris on May 5th 1932; this we also believe to be *C. i. indicus*. In this case also, the parent bird tried to distract our attention by much flapping along the ground. The two chicks kept their eyes tightly shut, and were so motionless and matched the stony ground so completely, that in our search for them we were actually looking at them for some time without realising their presence.

I enclose a photograph we took of the Ootacamund nightjar chicks. It will be seen in the photograph that the feathers where the chick is in contact with the ground when squatting are fluffy.

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Chicks of the Common Indian Nightjar (*Caprimulgus asiaticus*).

Photo by: *Author*

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This makes the outline of the bird obscure, and is no doubt an important factor in the camouflage.

MADRAS CHRISTIAN COLLEGE,
TAMBARAM,
CHINGLEPUT DISTRICT,
September 4, 1937.

ALICE D. BARNES.

XV.—ON THE BREEDING OF THE OYSTERCATCHER (*HAEMATOPUS OSTRALEGUS* SUBSP.) AND OTHER BIRDS IN THE BENGAL SUNDERBUNDS.

It seems high time that the rather terse statement in the second edition of the *Fauna* (vol. vi, 167) in regard to the Oystercatcher was amplified. Writing of the Chinese race (*Haematopus ostralegus osculans*) Mr. Baker says: 'An Oystercatcher, probably of this race, has been obtained with its eggs, breeding on an island in the Sunderbunds, but the skin has not been available for comparison.' This is repeated, almost word for word, by the same author in the *Waders and Semi-Sporting Birds of India*. The actual facts may perhaps now be placed on record.

In the Easter Holidays of April 1922, I had the good fortune to be the guest of Mr. L. R. Fawcus, I.C.S., then Collector of Khulna in Bengal. We spent then about 100 miles south of Khulna on the sea-shore, an area in which owing to the almost complete absence of fresh water, Man is, or was then, conspicuous by his absence, and which was a paradise for birds of all kinds, spotted deer, pig, etc. On April 21st we saw a pair of Oystercatchers on a long narrow strip with scattered stones along it. The next day (April 22nd) they were in the same place and we had little difficulty in watching the hen bird on to her nest which contained fresh eggs. These eggs we took and they were later given by Mr. Fawcus to Mr. Stuart Baker. The birds nested again near the same place and on a subsequent visit Mr. Fawcus saw the young ones. In the cold weather of 1933-34, he again saw a pair there but, as he only had a rifle, was unable to secure a specimen.

On the Easter Sunday, we rather foolishly tried to plod out across the mud of the bay to an island some three or four miles out at sea, over which we could see a great cloud of Terns hovering. This trip might well have ended disastrously, as, for the greater part of the journey, the mud was over our knees, and it was impossible to take more than six laborious steps at a time. Eventually after some hours we managed to struggle back to land and later just managed to reach the island at high-tide in a row-boat. We found it covered with a very large breeding colony of Gull-billed Terns (*Gelochelidon nilotica*) whose eggs—many quite fresh—were all over the island. They were remarkably tame and shewed little fear of our party. There were also two colonies, each of 30-40 pairs of the Large Crested Tern (*Thalasseus bergii*

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subsp.). Unlike those of the Gull-billed Tern, these nests were almost touching each other, bare hollows in the sand each containing one egg. The close-packed snowy mass of sitting birds was a most beautiful sight, and well worth the difficulty we had had in reaching them. Equally remarkable was the varied colouring of the eggs. I took one series of 18 eggs from adjoining nests, each different from the next and ranging in colour from heather-purple to almost pure white, but an accident unfortunately destroyed a number of these before they reached the South Kensington Museum in 1923.

On the same island, we found a nest of *Esacus recurvirostris*, the Great Stone Plover, with one of the eggs just chipping. This bird went back on to her eggs while I sat within fifteen yards of her, being doubtless anxious to shield the eggs from the fierce midday sun. She sat there on them panting with her mandibles open.

When on leave in 1923, I met Mr. F. C. R. Jourdain and Mr. Stuart Baker at the South Kensington Museum and told them the above facts. The eggs of the Oystercatcher and some other eggs were eventually given by Mr. Fawcus to Mr. Baker, with full data as to their origin. It was not however possible to obtain skins to decide the geographical races of the birds mentioned.

Since this trip, which I owe to Mr. Fawcus' kindness, I have kept a close lookout for the Oystercatcher in Burma without success. It is not likely to occur in 'North Burma' (*Fauna*) where there is no sea-coast but may well occur from Arakan South and East to the Tenasserim coast. Mr. S. F. Hopwood tells me he saw Oystercatchers near China Bakir (Hanthawaddy) about 1927 (*J.B.N.H.S.*, xxxvii, 4 April 1935) and Mr. C. E. Milner shot one on the Bassein coast in 1914.

It is improbable that they breed, except very locally, on the Burma coast. I have searched several areas for them in vain.

WINCHESTER,
May 3, 1937.

J. K. STANFORD,
Indian Civil Service.

XVI—EARLY AND LATE SNIPE.

I find from my game book from entries of 30 years that the earliest I have shot snipe in India is 1st September at Loralai and also on the same day of the month at Peshawar. I have seen snipe in Baluchistan, but not shot any, on 20th August. In Southern India, Hyderabad, I have generally got my first snipe early in October and once, this year, the 20th September. Other guns got snipe early in September this year at Hyderabad.

In Northern India and Baluchistan I have shot snipe up till the end of March with an occasional bird in April and a good bag at Parachinar in the Kurram Valley in April.

In Hyderabad I have shot snipe every year as late as the first week of April and this year got 3½ couple of full snipe at Bijapur

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in Bastar State on 18th April. Last year in South Chanda, C.P., not far from Bijapur I saw several snipes on 17th April.

All the April snipes I have shot and seen in Hyderabad and Chanda have been in wooded cover near permanent springs or in the soakage behind the embankments of big tanks. These snipes are very dark in colour, sluggish in flight and inclined to lie very close especially in undergrowth. When flushed they utter a cry quite different from the ordinary 'scrape' of a snipe.

The number seem very late and this year also the early snipe gives the impression that they are family units and that the birds remain in India all the summer, possibly breeding here. It would be very easy to get someone to observe the tank at Bijapur, because the snipe there are well known to the local people and are found along and below the embankment between the two halves of the village.

H.Q. 4TH (SEC'BAD) CAVALRY BRIGADE,
BOLARUM.
April 26, 1937.

G. de La P. BERESFORD, M.C.
Brigadier.

XVII.—THE BREEDING OF THE LITTLE GREEN BITTERN (*BUTORIDES STRIATUS JAVANICUS*) IN SALSETTE ISLAND.

On the 30th May (1937) I found a nest containing three young of the Little Green Heron Bittern (*Butorides striatus javanicus*) at Ghorbunder. The nest, a rude construction of loosely-put-together twigs, was situated in the thin branches of a mango tree some thirty feet from the ground. The tree was some distance from the water's edge of the creek.

The three young showed a remarkable range in size, but this was particularly true of the smallest, which was almost half the size of the other two—probably a weakling. On approaching the nest the 'youngest' bird remained sitting in the nest while the other two walked out of it on to the thinnest branch for safety and were captured with some difficulty. Besides being able to walk with ease along the thin branches, I noticed that they used with good effect their necks as 'hook' to aid them in climbing. The neck would be hooked over a branch and the legs then brought up and with a little flapping they would lift themselves on the new perch.

The young were partially in down but the quills of the feathers were in evidence all over. The down is a dark smoky grey all over except round the belly where it is almost white.

The parent bird (male) returned shortly after being disturbed and was secured. On examining the gullet, which seemed swollen, it was found to contain 2 specimens of *Belone strongylura* V. Hass, 8½ and 6½ inches long respectively and the head of a Syagnaid.

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This bird is a local resident, but as far as I am aware the nest has not been recorded from the area.

BOMBAY NATURAL HISTORY SOCIETY,
BOMBAY, C. McCANN.
May 31, 1937.

XVIII.—OCCURRENCE OF THE BITTERN (*BOTAURUS S. STELLARIS*) IN SOUTH MYSORE.

While shooting round the edge of a tank near Nanjangud, about 12 miles south of Mysore City, on 12 December 1936, I flushed a Bittern from the reeds and shot it.

As this bird is stated in *F.B.I.*, 2nd edition to range only so far as Bangalore, its occurrence nearly 100 miles still further south may be worth recording.

Identification was kindly confirmed by Mr. Hugh Whistler to whom a wing was sent.

KALHATTI E. G. PHYTHIAN-ADAMS.
NILGIRIS, *Major I.A.* (*Retired*).
April 24, 1937.

XIX.—SEXUAL DIMORPHISM IN THE STAR-SHELLED TORTOISE (*TESTUDO ELEGANS*).

Apart from the characteristic concavity observed in the males of most Chelonians, and the frequent disparity in size often observed between the sexes, little seems to have been recorded regarding the sexual characters. Recently the Society received two pairs of the Star-shelled Tortoise (*Testudo elegans*) from H .H. The Maharaja of Bhavnagar. A careful examination of the specimens showed clearly marked sexual differences.

Carapace: In the females the colouring of the shell is much brighter and more pronounced, the humping of the dorsal shields (in particular) is much more pronounced, and the posterior and anterior marginal shields are far more serrated and the points more acute.

Legs: The forelegs in the females carry large and more conical scales (almost free in the upper $\frac{2}{3}$) and the hind feet are armed with much longer claws, probably a provision for excavating the egg chamber at the time of deposition.

Tail: In females the tail is reduced to a mere short conical stump whereas in the males it is much more elongated and if straightened will protrude almost a couple of inches beyond the

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shell. Normally, however, the tail is carried adpressed to the shell, curled up behind either of the hind legs.

The above details apply to adult specimens.

BOMBAY NATURAL HISTORY SOCIETY,
BOMBAY, C. McCANN.
August 4, 1937.

XX.—OCCURRENCE OF *PSAMMOPHIS CONDANARUS* ? IN BERAR.

A snake found at Chikalda (Berar) at about 3,500 ft. in the Melghat hills by E. Berchten in June 1937 seems to come nearest to the above. It agrees with the descriptions of this species by Wall (*How to Identify the Snakes of India*, 1923) and Boulenger (*F.B.I.*, Reptilia & Batrachia, 1890) except on the following points:—It disagrees with Wall in having 15 instead of 17 rows at 2 head-lengths behind head and only 1st (not 1st and second) supralabials touching the nasal. The localities given by Wall are 'Cutch, Punjab, Sind, Ganges basin and Burma'.

It disagrees with Boulenger mainly in colour (rather markedly) and in the distribution which he gives as 'This species has hitherto only been recorded from the Punjab, Cutch, the North-West Provinces, Simla, Bengal, the Kurnool district, and Pegu'.

The following is a general description of the specimen sent. Length 10 in. Costals 15; 17; 13; Ventrals 173; Sub-caudals 74; Anal divided; one rather long loreal. Scaling of the tree-snake type without apical pits or ventral keel.

Colour: The head is pale olive brown above with a darker line from the snout, passing through the eye and fading on the nape; the upper and lower lips, chin and throat are pure shining white, each infralabial and some of the adjacent scales of the throat having a rusty speck (marking a pit?) in the centre of each. The upper parts of the body are pale olive brown above fading a little on the flanks. There is a dark brown median stripe edged sharply with black formed as follows:—The vertebral row and one row on either side of it dark brown, the next row on either side has each scale dark brown on its inner edge, black in the middle and pale olive, like the rest of the upper surface, on its outer edge. The belly is yellow each ventral having a rusty line near each end. These lines are shorter in front but become almost continuous from about mid-body onwards. The iris is pale yellow and the pupil round.

FOREST OFFICE,
NAGPUR, C.P., E. O. SHEBBEARE.
June 19, 1937.

[The specimen referred to above was submitted to Dr. Malcolm Smith for verification and we give below his reply.

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'Many thanks for the interesting snake. I identify it provisionally as *Psammophis condanarus*, which is more variable in colour than is usually supposed.'—EDS.].

XXI.—SEXUAL DIMORPHISM IN THE SEASNAKE [*DISTIRA CYANOCINCTA* (DAUD.)].

On the 3rd May this year, Mr. J. B. Greaves, sent the Society a pair of live *Distira cyanocincta* which he had found in copulation at Mervi-mahad, near Bombay. While examining the specimens I noticed that they exhibited certain differences which may be recorded as possible sexual characters.

(*a*) The colour banding of the body in the male was markedly stronger, and the rings were more complete than in the female.

(*b*) The low jaw in the male was very distinctly coloured burnt sienna fading out a little beyond the base of the head. The colouration was not present in the female.

(*c*) In the female the head was much more elongate than in the male.

(*d*) The tail in the male was markedly thicker than in the female.

(*e*) In the male the scales of the body and particularly those on the head, were strongly keeled, much more so than in the female. The scales of the female were much smoother and more shiny, particularly the head scales.

Later, on consulting Col. Wall's *A Popular Treatise on the Common Indian Snakes* (*J.B.N.H.S.*, xxvi, p. 436) I have found the following remark :—'The very distinctive keels and their serrations are much more conspicuous in males where they are sometimes most pronounced and even spinous on the belly. In females and young though somewhat obscure they are usually discernible if looked for.'

With regard to the time of the year when this species breeds in India, Col. Wall has no information owing to the specimens he examined having no date. However, for Siam he records a gravid female, from the Chantabum river, as having been captured in March (1916). This specimen contained embryos 10--10½ inches long. In the present instance the female measured 3 ft. 9 in. long and contained approximately 30 eggs of various sizes, the largest of which measured 1 × ¼ in.

BOMBAY NATURAL HISTORY SOCIETY,
BOMBAY.
May 20, 1937.

C. McCANN.

XXII.—BREEDING SEASON OF THE JEW'S NOSED SEASNAKE [*ENHYDRINA VALAKADYEN* (BOIE)] IN BOMBAY WATERS.

On the 15th March this year (1937) a large female of the Jew's Nosed Seasnake (*Enhydrina valakadyen*) was caught in the fishermen's net at Mora, Uran Island. On dissection the specimen was

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found to contain eleven eggs, with embryos measuring approximately 42.5 mm.

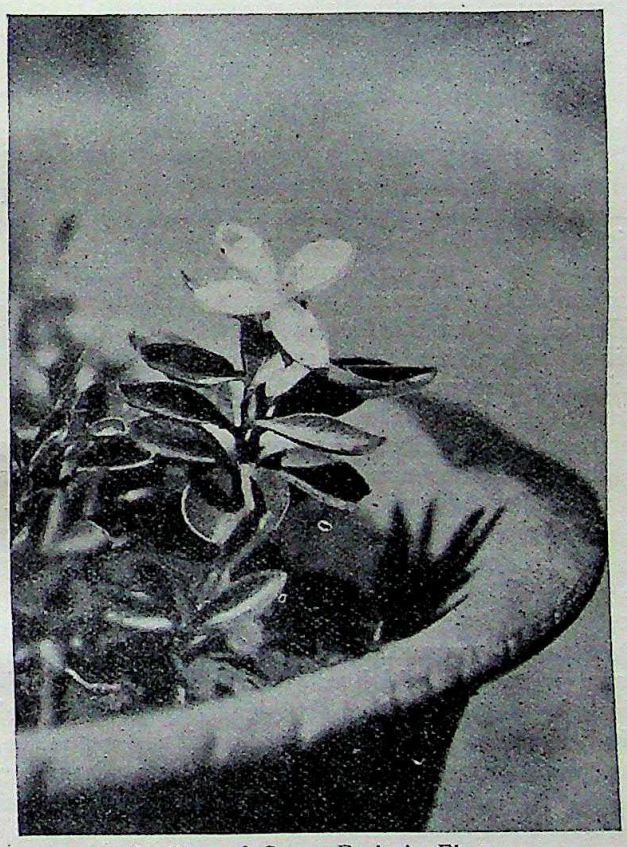
Col. Wall in his paper *A Popular Treatise on the Common Indian Snakes* (*J.B.N.H.S.*, xxvi, 805) states that the breeding period varies from 12th November till February in Cannanore, and that young measuring 12½-17 inches were obtained from Madras in June. The Bombay specimens would thus breed a little later than those in South India.

BOMBAY NATURAL HISTORY SOCIETY,
BOMBAY. C. McCANN.

May 27, 1937.

XXIII.—FREAK SEEDLING OF THE GRAPE FRUIT.

(*With a photo*).



Seedling of Grape Fruit in Flower.

A Grape Fruit seedling two months old, in flower. This is considered very uncommon with this particular variety of Citrus plants as they are not known to flower before the seventh year.

NO. 11 COLVIN ROAD,
ALLAHABAD. MRS. MARGARET RATH.

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XXIV.—SOME OBSERVATIONS ON BOTANICAL NOMENCLATURE.

Alteration in the botanical names by which plants are known is so frequent a cause of complaint, especially by applied botanists, that is to say horticulturists, agriculturists, foresters, etc., that some explanation for the reasons underlying such changes seems desirable.

In the early days of plant classification the names used were vague and often consisted of several words giving a brief description of the plant. For instance: the common Elder was termed *Sambucus caule arboreo ramoso floribus umbellatis* by Royen in 1740. At that period too, and for many years after, there was comparatively little communication between botanists and but little literature and small opportunity for comparing plants handled by the several workers. Everyone had to depend almost entirely on the published descriptions. As few species were then known it was considered that brief indication of the general relationship and one or two individual characters sufficed, with the result that the descriptions were usually meagre and have proved often very inadequate for the determination of the plant without seeing the very specimen from which the description was made. Given these premises it will readily be apprehended that quite frequently the same species was separately named and described by different workers under different names, and, on the other hand, different workers identified entirely different plants with some other named and described by another scientist. An example of these sources of error will be found in the genus *Terminalia*. Linnaeus described one species under the name of *Terminalia Catappa*; at a somewhat later date Lamark described the same species as *T. moluccana;* later still Roxburgh, believing that he had the same species as Lamark's, identified with it one of the varieties of *T. belerica;* finally Wallich inscribed the same name on a sheet of his Herbarium Catalogue. Thus we have three separate species to which the name *T. moluccana* has been applied.

The first great step towards an orderly nomenclature was taken by the Swede Carl von Linné, who, in 1753, propounded the binomial system under which every species of plant bears two names only: the first is that of the genus to which it belongs and therefore indicates its general affinity, and the second is its individual or specific epithet. This was an obvious advantage in every direction, especially in brevity for now the common Elder becomes *Sambucus nigra* of Linnaeus.

Nevertheless, this system in itself does not dispel the confusion occasioned by the factors explained above, a confusion that assumed such alarming proportions that it was found necessary to discuss the situation at the International Botanical Congress held in Paris in 1867. A set of rules drawn up by Alphonse de Candolle was adopted under the title: 'Lois de la nomenclature de botanique.' Experience showed, however, that these rules were not 'fool-proof'

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but lent themselves to diverse interpretations in part. Consequently, at the second International Congress at Vienna in 1905 they were further discussed and certain modifications were accepted and incorporated in the International Rules of Nomenclature. Additions and modifications have been effected at subsequent meetings of the Congress, including the last that took place at Amsterdam in 1935. The resolutions carried on this last occasion are still being investigated and formulated by the appropriate committees and their publication may be expected by the end of 1936 or soon after.

The following are some of the more important points in the rules as they now stand:

1. The name of any species must consist of a combination of a generic name followed by a specific epithet. They may be followed by the name of a further subdivision, e.g. a varietal name.

2. The same name cannot be applied to distinct genera, nor the same epithet to two distinct species in the same genus.

3. No name is accepted unless it is *effectively published*: that is to say, that it has been made known generally to botanists by publication in some accessible work and is accompanied by a description of the group or by detailed figures. Therefore, mere names unaccompanied by a description or only in manuscript or not generally accessible to botanists, are not valid.

4. When choice has to be made between two validly published names applied to the same plant, the rule of priority comes into play and the earlier published name must be accepted, subject to the exceptions noted later.

5. Priority is based on the year of publication of Linnaeus's fundamental work *Species Plantarum* in 1753. Names published earlier than that need not be taken into account.

6. A validly published name, even though illegitimate under the rules, is not available for a different plant. Thus: *Picea Abies* is the correct name under the rules for the common Spruce. *Abies Picea* was the combination applied to the same species by Miller in 1768; but for this fact this last combination would be the correct name for the silver fir for which it cannot be used under the rules as it is preoccupied, and the silver fir must bear the name *Abies alba* Mill.

7. Recognising that changes in generic names are to be avoided as far as possible, especially where well-known names are concerned, it was decided to establish a list of 'nomina conservanda' which preserves certain generic names as against obscure though more correct ones if priority were strictly adhered to, e.g. the genus *Ailanthus* of Desfontaines (1789) is conserved in preference to *Pongelion* of Adanson (1763). This rule does not apply to specific names, which cannot be conserved.

8. The name of the author of a generic name or a specific combination should be written (often abbreviated) after the name. When a species is transferred from one genus to another the specific epithet is retained and the name of the original author should appear in brackets followed by that of the transferer.

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Thus, the first name given to the common Spruce by Linnaeus was *Pinus Abies*. Subsequently the plant was transferred to the genus *Picea* by Karsten and became *Picea Abies* (Linn.) Karst.

This citation of the author is essentially an abbreviated reference to the place of publication and also indicates approximately the date of publication. Further, it is very necessary in cases where more than one species has been given one and the same name as with *Terminalia moluccana* mentioned earlier.

The above epitome is, of course, far from exhaustive; a full discussion would take far too much space. I would refer anyone anxious for a fuller account to an excellent résumé by Miss M. L. Green which appeared in vol. 10, No. 1 of the *Empire Forestry Journal* in 1931. Indeed, I have had this publication under constant reference while compiling this note and have, in places, copied the wording and used the illustrations.

We may now consider the main reasons which make a change of name imperative.

1. If the same name is given to two different species the one described and validly published at the earlier date retains the name and the other must have a new name. This has occurred in the case of genera as well as of species. An example of the former lies in *Bassia*. In 1766 Allioni bestowed that name on an Australian genus of the *Chenopodiaceae*. Koenig suggested the same name for a genus of the family *Sapotaceae* and this was accepted and published by the younger Linnaeus in 1771. As two genera cannot bear the same name and Allioni was the first to publish it, *Bassia* must remain the name for the genus in the *Chenopodiaceae* and the later genus must take the next available name given to it which is *Madhuca*, by which name the Indian trees previously grouped under the name *Bassia* must now be known.

2. When a species has been misidentified with a validly described species and is discovered to be something different, it must receive another name. I have already cited as an instance the case of *Terminalia moluccana*.

3. When a genus is subdivided into two or more genera, one of the divisions will retain the original name and the others will be provided with fresh generic names. As a case in point I may cite the large genus *Eugenia* from which the genera *Syzygium*, *Jambosa* and *Meteoromyrtus* have been segregated. The original specific epithets must be retained in the new genera unless the combination has already been used, as was indicated in the case of *Abies Picea*.

4. When the true identity of an effectively published plant, which was uncertain for one reason or another, is established and it is found to be identical with another plant described at a later date, the first published name must stand. Thus, *Cyperus imbricatus* of Retzius being insufficiently described was considered to be unidentifiable and was omitted from the *Flora of British India*. The original specimen on which Retzius founded this species came to light and it was then found to be identical with the sedge described at a much later date by Vahl under the name *C. radiatus*.

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This latter binomial must relapse into synonymy and Retzius's name stands as the correct name for the species.

Those engaged on the economic application of botanical knowledge have represented that they have neither the time nor the facilities for keeping abreast with nomenclatural research and often are unable to ascertain the correct name that should be applied to some important species owing to the changes enforced by the rules. This difficulty was admitted at the Congress at Amsterdam in 1935. Accordingly, it was resolved to draw up a list of the important economic and ornamental plants named in accordance with the International Rules, which list shall remain in force for the usage of such applied botanists for a period of ten years. A special committee was appointed to consider all the species for which claim for inclusion has been put forward and it is hoped that the list will be ready for publication before long.

KEW.

C. E. C. FISCHER.

XXV.—THE FLOWERING OF *STROBILANTHES*.

I am afraid this note is somewhat belated and contains very imperfect information, but I have just been re-reading Mrs. Robinson's article published in vol. xxxviii, No. 1 of 15-8-35 and think it may contain some scraps of information which may be of interest.

At least four species of *Strobilanthes* flowered profusely in every sholah on these hills between the months of August 1936 and April 1937, in fact almost every *Strobilanthes* plant growing under our heavy evergreen forest seems to have flowered and died during this period. The sholahs on our grass hills, where the undergrowth was almost entirely *Strobilanthes*, now present an extraordinary appearance in being bare of undergrowth where a short time ago they were dense. The bison who browse freely on *Strobilanthes* leaves must find their feeding somewhat restricted. In the dry months of the year from December to March the bison often do not visit the dry grass for quite long periods but stay inside any sholah which is large and thick enough, browsing on *Strobilanthes* and other shrubs.

I am afraid I do not know enough about the genus to identify each species positively, but you may be able to identify some of them from the following descriptions. I would emphasise that every plant I have seen flowering in this period has been growing either in, or on the edge, of evergreen forest. The big flowering of *S. Kunthianus* which I reported in 1934 all took place on the open grass land and I saw none of it flowering in the open this year; in fact the seedlings from this flowering are only just beginning to show up in any quantity.

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The following are the distinct forms I noted in this present flowering.

(1) A dense growing shrub with small thin bright green smooth leaves, growing up to 8 ft. high on fairly thin stems which tend to bend over under the weight of leaves and flowers. The flowers are carried on the stems in bunches and at first glance the clusters of buds look exactly like large ears of oats or Brome Grass. The buds and flowers are sticky to the touch although the leaves are smooth. The flower is small. It is often white and occasionally tinged with a delicate blue.

The plant is very common on the edges of all the jungle belts here, 3,600 ft. and is equally common at 6,000 ft. It thrives in any place where the jungle is thin and it can get a bit light, but does not do well where the jungle is thick. It was the first to appear in flower and the last to finish. I can remember having seen this in flower before shortly after I came here in 1924, but have no record of the date although I think it was probably 1925-6.

(2) A big sturdy shrub which grows thickly to about 7-8 ft. in our swamps and anywhere on the edges of jungle where there is moisture, such as round the edges of rock outcrops.

The stems are sturdy and thick; the leaves are big and broad, very prettily tinged with dark red underneath, and are rough and hairy. The florescence is a compact dark brown cone about 3 to 4 inches long very like a polished fir cone to look at and about the same thickness. Each flower in the cone opens individually and barely shows up as a very dark blue with orange red stamens. The flower stem is so short that when open each flower only just protrudes from the cone and except for the orange colour of the stamens might not be noticed at all.

Like the first I have seen this flowering before and at the same time about 1925-6.

(3) A plant very similar in general appearance to the last with broad hairy dark green leaves but no under tinge or red. This grows well under heavy shade as well as on lighter patches and the stems are often thick enough to use for walking sticks. The flower is a mauvy blue. It is common in sholah at all elevations but particularly so in the stunted jungle at the open grass level 6-8,000 ft. I have not seen it flowering before, and as far as I can remember since 1925, the sholahs on the grass hills where it has now flowered and died have always had a plentiful supply of this undergrowth.

(4) A plant with much smaller dark green rough leaves and of a much denser shrubby appearance growing up to about 5-8 ft. high. The flower is a delicate mauvy blue. This also prefers the lighter edges of jungle and rock out-crops. I think this is probably *Kunthianus*, the increased growth of the bush being due to its growing under shelter and not in the open. I have not seen this flowering before.

I am sorry that this note is not more exact and that I did not collect specimens, but it is probably worth while recording for the future reference of anyone in 1947-8. It is of interest that the S.W. monsoon of 1935 was very much more open and sunny than

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usual, and very much below normal rainfall; in fact it might almost be said to have failed us. Possibly this had something to do with the determining of the flowering season. A mass of small seedlings germinated in May this year wherever there had been a flowering. Our first rain showers arrived at the end of March and there were fairly continuous showers through April.

INJIPARA ESTATE,
VALPARAI P.O.,
June 7, 1937.

J. H. L. WILLIAMS.

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BOMBAY NATURAL HISTORY SOCIETY.

A meeting of members of the Bombay Natural History Society and their friends was held at the Prince of Wales Museum on Wednesday the 25th August 1937 at 6.30 p.m., the Hon'ble Justice K. W. Barlee, Kt. presiding.

The Honorary Secretary, Mr. H. M. McGusty, announced the election of the following twenty-five members since the beginning of the year:—

Mr. A. J. Yandle, Moran P.O., Assam; Mrs. Phyllis M. Spreadbury, Burma; The Secretary, Cachar Club, Ltd. Silchar; Mr. B. Basu, Khar, Bombay; Mr. L. D. Scott, Kuweit, Persian Gulf; Mr. J. D. Sherston Baker, Bombay; Mr. C. A. Emerson, Colaba, Bombay; The President, Malda Game Association, Malda, C.P.; Brother Godfrey, I.S.C., St. Placid's School, Chittagong; Mr. J. N. A. James, Bombay; Mr. C. E. Fischer, R.E., Fategarh, U.P.; Dr. F. B. Khambatta, M.B., B.S., M.R.C.S., L.R.C.P., D.P.H., D.T.M. & H., Bandikui; Capt. R. S. McGregor, Jubbulpore; His Majesty S.M. Bao-Dai, Emperor of Annam, Hue, French Indo-China; Mr. Lionel J. Dee, Coimbatore; M. K. S. Fatehsinhji, Bhuj, Kutch; Mr. C. Gore, Assam; Mr. E. R. Sherman-James, Assam; Mr. M. C. C. Turner, Bombay; The Principal, Queen Mary's High School, Bombay; The Principal, St. Berchman's College, Changanacherry, Travancore; Mr. Gordon Williams, Gangapur; Mr. H. R. D. Robey, Assam; Capt. R. S. Vine, R.A.M.C., Wellington, Nilgiris; and Mr. H. R. Lindsay, Punalur, S.I.

Mr. Sālim Ali, a former Assistant Curator of the Society, then read a paper on an Ornithological trip to Afghanistan during the early part of this year.

His account of the expedition was made all the more interesting by the display of a number of well-chosen lantern slides.

An Ornithological Trip to Afghanistan.

The Expedition was financed and led by the celebrated British Ornithologist Col. R. Meinertzhagen, D.S.O. Its objects were to collect birds, plants and other Natural History specimens and to study ecological conditions in the field. Col. Meinertzhagen is one of the world's foremost authorities on *Mallophaga*, a group of external parasites of birds, and the collection of these was his own special department.

The country north of Kabul was visited up to the Oxus river which forms the northern boundary between Afghanistan and Russia. The method of transport in Afghanistan is chiefly by motor lorries. The roads are passable, but likely to become slushy and dangerous in the rainy season. Travelling and camping out is perfectly safe in modern Afghanistan. Punishments for crime are drastic, and theft is practically unknown. The expedition spent two months camping in the open. The motor lorry was left by the roadside unattended, with baggage and ammunition on board, and not a single article was lost.

The bird life belongs chiefly to the Palæarctic Zone, but there is also a sprinkling of Ethiopian and Indo-Malayan forms.

The bird collection includes many interesting forms, some which are likely to prove new to science.

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The collections and data are being co-ordinated and worked out by Col. Meinertzhagen in England. The full report, it is hoped, will be published by the end of the year.

Some of the Expedition's most valuable experiences in Afghanistan were with migrating birds returning in Spring to their breeding grounds in Central Asia and Siberia. Many birds that winter in India and Africa migrate over Afghanistan. This fact had been long surmised but not established until the expedition was able to confirm it.

Mass movements of a large number of species was observed. In particularly large numbers were the Rosy Pastors—familiar winter visitors to India. These birds are some of Man's staunchest allies in his fight against the destructive locusts. They breed in Central Asia and their breeding grounds usually coincide with those of the locust. The young Pastors are fed from the time they are born up to when they leave their breeding grounds almost exclusively on locusts in the various stages of the insect's growth. Although largely netted, killed and eaten in India, the Afghans protect the Pastors zealously on account of their usefulness.

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